

QCFSE

23.3.5

# **Performance Evaluation of Remedial Action**

## **Queen City Farms, King County, Washington**

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May 2000



## EXECUTIVE SUMMARY

The Queen City Farms (QCF) site was used as a waste disposal site from the mid-1950's to late-1960's and has been the subject of investigation and remediation activity since 1980. Environmental concerns arising from historic waste disposal activities had resulted in subsurface impact on soil and groundwater. Several investigations and remediation activities have been carried out. The most-recent remediation activities were in response to a Consent Decree issued 8 November 1993 and involved construction of a vertical subsurface barrier and cap, or Final Containment Cell (FCC), around a contaminated zone. One of the requirements of the Consent Decree was that the effects of the remedial action were to be reviewed and the performance evaluated with respect to the overall goal of reducing environmental impacts of the site.

The purpose of this report is to present an evaluation of the monitoring data collected since the remedial activity and to determine whether the action has been, or will be, adequate to meet the requirements of the Consent Decree.

The groundwater system is comprised of five water-bearing zones. Nearest to the surface, the Near-Surface-Water-Bearing Zone (NSWBZ), composed of permeable outwash deposits underlain by a thick till. Adjacent to the NSWBZ, a perched aquifer (Aquifer 1) is present in highly permeable glacial deposits composed of sands, gravels, cobbles and boulders which are underlain by a till and clayey aquitard and thick unsaturated zone. Aquifer 2 consists primarily of fine to medium sand and silty sand with occasional discontinuous silty layers. The saturated thickness of Aquifer 2 is between 30 and 55 feet. The upper portion of Aquifer 2 is more permeable than the lower portion, consisting of Vashon outwash deposits. Aquifer 2 is believed to pinch out in the eastern portion of the site.

The primary cleanup objective for Aquifer 1 remediation is protection of Aquifer 2. The Consent Decree requires a statistical trend analysis of groundwater monitoring data which will form the basis for evaluating the necessity of implementing active aquifer restoration. If the trend analysis reveals that contaminant concentrations within Aquifer 1 will not achieve a  $1 \times 10^{-5}$  cumulative cancer risk within five years after construction of the FCC, then extraction and treatment of Aquifer 1 may be implemented. Minimum performance standards have been specified for constituents of concern (COCs) in Aquifer 1 and 2.

The primary remedial objective for Aquifer 2 is the onsite containment of the Aquifer 2 TCE plume. A long-term goal is restoration of Aquifer 2 to its beneficial use. If plume expansion is detected, groundwater extraction may be implemented to reduce the size of the plume.

The expected response of the hydrogeologic system to the FCC is briefly described below:

- Disruption of flow in Aquifer 1 due to decreased aquifer storage and perhaps increased piezometric levels.
- Diversion of groundwater flow around the barrier wall
- Decline of groundwater levels inside the barrier wall
- Reduction in concentration levels in Aquifer 1

- Reduction in concentration levels in Aquifer 2

In order to ascertain trends in concentration at a particular monitoring well, time-series plots of monitoring data were prepared. In order to provide a gross estimate of the time required for concentration trends to reach the performance standard, a linear regression of post-construction data was performed. A statistical analysis of constituent concentrations was performed to determine trend and also to assess compliance. Monitoring data was divided into three groups for analysis: pre-construction (before September 1996), post-construction (after September 1996), and previous eight (8) quarters (1998 and 1999 data). The statistical analyses are intended to form the basis for evaluating the necessity of implementing active aquifer restoration such as groundwater extraction and treatment.

According to the Consent Decree such remedial action may be required if the following conditions are not met based on the statistical analysis:

- Aquifer 1 risk level is reduced below  $1 \times 10^{-5}$  within five (5) years after construction of the FCC,
- Aquifer 1 concentrations of COCs in groundwater are predicted to be less than the performance standards,
- In Aquifer 2, the 5 µg/L TCE plume boundary is decreasing or stable,
- In Aquifer 2, constituent concentrations outside the conditional point of compliance achieve the  $1 \times 10^{-5}$  cumulative cancer risk within ten (10) years after construction of the FCC.

In order for groundwater to be in compliance, the data must meet the following conditions: i) the 95% upper confidence limit (UCL) must be less than the performance standard, and, ii) no single sample in the previous eight consecutive quarters shall be more than two times the performance standard, and, iii) less than 10% of samples shall not exceed the performance standard for the sampling period.

Prior to installation of the vertical barrier, water levels in Aquifer 1 were highest during winter months and lowest during summer/fall. Completion of the FCC resulted in rapid and dramatic declines in water levels inside the FCC. Water levels inside the wall declined to an elevation range of 403 to 413 ft asl by the end of 1999. This is the approximate level of the aquitard and indicates that Aquifer 1 has been essentially dewatered. In contrast to water levels within the FCC, Aquifer 1 outside the FCC continues to show a seasonal fluctuation at historic levels but have less amplitude of change. The level of Queen City Lake also continues to fluctuate but the amplitude and rate of change in level appears to have lessened following construction. It is apparent that the flux of water into the FCC is much less than the flux out resulting in dewatering of this portion of Aquifer 1.

Groundwater quality within the FCC does not appear to have been affected by construction and most constituent concentrations remain above the performance standards. Outside the FCC, significant and rapid reductions in constituent concentrations were observed in the western portion of Aquifer 1. The concentrations of TCE, cDCE and VC have met the performance standards at E1, E1a and Z-1. Only one sample has exceeded the chromium standard since construction of the FCC (at E1a).

Two springs which drain Aquifer 1 have been monitored for water quality. The western spring (EC-2) has met the performance standards for all COCs. The eastern spring (SP-5) meets the standard for

all COCs except chromium. Dissolved chromium concentration appears to be declining, but remains above the standard.

Construction of the FCC has resulted in increased volume of water reaching Gravel Pit Lake and therefore increased infiltration to Aquifer 2. Potentiometric contours for 1999 suggest that the area of groundwater mounding due to recharge in Aquifer 2 has increased. The general flow regime in Aquifer 2 has not changed substantially and a radial flow pattern from the Gravel Pit Lake area remains.

TCE is the only constituent of concern that occurs at concentrations above the performance standard in Aquifer 2. Wells located in the upper portion of Aquifer 2 outside of the conditional point of compliance have generally declined in TCE concentration, and only two wells contained TCE above the performance standard: L2a and V2a. Both of these wells have 95% upper confidence limits of TCE that are approximately twice the standard, and are located near the north perimeter of the plume.

The concentration of TCE in the lower portion of Aquifer 2 remain generally higher than the upper portion. The distribution of the TCE plume in 1999 is consistent with previous evaluations and the extent of the plume as determined by the 5 µg/L boundary remains stable on the west, south and east perimeter. Only two wells in the lower Aquifer 2 outside of the conditional point of compliance, contain TCE above the standard: L2 and M2. These wells have statistically significant decreasing trends.

A linear regression analysis of TCE time-series data since construction was used to estimate the time required for TCE concentration to meet the performance standard in wells where it has been detected. Such an analysis is considered to only provide a general indication of the time required, but it was found that between 1 and 26 years would be required for the trends to reach the standard in wells outside of the conditional point of compliance. The only well outside of the conditional point of compliance that would not likely meet the standard within 10 years of construction is located along the northern perimeter at L2. Wells within the conditional point of compliance are not expected to meet the TCE standard within the 10 year post-construction period, based on the linear regression analysis.

The observed response of the hydrogeologic system to construction of the FCC leads to the conclusion that the FCC is performing as designed and has reduced the flux of water through the contaminated zone.



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## 1 INTRODUCTION

The Queen City Farms (QCF) site was used as a waste disposal site from the mid-1950's to late-1960's and has been the subject of investigation and remediation activity since 1980. Environmental concerns arising from historic waste disposal activities had resulted in subsurface impact on soil and groundwater. Several investigations and remediation activities have been carried out. The most-recent remediation activities were in response to a Consent Decree effective September 9, 1994 and involved construction of a vertical subsurface barrier and cap around a contaminated zone, referred to as the Final Containment Cell (FCC). One of the requirements of the Consent Decree was that the effects of the remedial action were to be reviewed and the performance evaluated with respect to the overall goal of reducing environmental impacts of the site.

The purpose of this report is to present an evaluation of the monitoring data collected since the remedial activity and to determine whether the action has been, or will be, adequate to meet the requirements of the Consent Decree.

The report is organized to provide background information concerning the site conditions, a description of the remedial action that was performed, the expected benefits of the remedial action, the conceptual site model and review of the results of monitoring that has been conducted since the remedial action. The monitoring results are interpreted within the context of the existing conceptual site hydrogeological model to determine whether the remedial action has met performance expectations at this time.

### 1.1 Site Setting

The 320 acre Queen City Farms site is located approximately three miles northwest of Maple Valley, King County Washington (Figure 1). It is situated in a predominantly rural wooded residential neighborhood. North of QCF is the Cedar Hills Landfill operated by King County.

The site is underlain by glacial deposits which include till, ice contact and outwash deposits. Stratigraphic relationships between deposits are complex and geologic conditions have an important influence on the behavior and migration of groundwater. Well-sorted sand and gravel deposits in the central portion of the site have been mined and the south portion of the remediated area is dominated by a gravel pit face over 100 feet in height.

QCF is located within a topographically closed basin. Surface runoff collects in seasonal lakes (Queen City Lake and Gravel Pit Lake) which are important to groundwater recharge.

### 1.2 Site History

The QCF site was originally operated as a pig farm. Waste disposal activities occurred at the site from approximately 1955 to the late 1960's when local industries used the site for disposal of industrial waste. Wastes including paint, organic solvents and oils were discharged from tanker trucks and drums into three unlined ponds. In 1980, the waste ponds were first sampled by EPA. A field investigation commenced in 1983 and several investigations were subsequently completed. Landau Associates (1990 and 1992a) provide results of field investigations.

Past remedial and removal activities have addressed two areas of the site:

- Ponds 1,2 and 3,
- The Buried Drum Area (BDA),

During 1985 and 1986, an Initial Remedial Measure (IRM) for Ponds 1,2 and 3 was conducted to separate, stabilize and remove sludge from the ponds, divert ground and surface water from contaminated soil beneath the former ponds, install a cap over the remaining contaminated soils and install a groundwater monitoring system.

The BDA located south of Queen City Lake and west of the IRM area was identified in 1988 containing buried drums with PCBs, polycyclic aromatic hydrocarbons, pentachlorophenol, toluene, ethylbenzene, tetrachloroethene, xylenes and heavy metals. Subsequently, drums and heavily contaminated soil was removed from the site in 1988 and later in 1995.

### 1.3 Description of the Remedial Action

A Consent Decree agreed to in 1993 required additional remedial action for specific areas of the site. The measures and cleanup performance standards for the remedy as stated in the Consent Decree are outlined below.

*For the Initial Remedial Measures Area and associated groundwater contamination:*

- Isolation of contaminated soils by construction of a vertical barrier system around the IRM to minimize intrusion of groundwater from Aquifer 1 and the near-surface water-bearing zone. A bentonite slurry wall was constructed during 1996 and the wall was completed in September 1996.
- Extraction, onsite or offsite treatment and discharge of the water from within the IRM
- Expansion of the existing IRM cap to include the area bounded by the vertical barrier wall. Extension of the existing surface water drainage system to the cap expansion area. The cap was completed in December 1996.
- Contingent extraction and treatment of Aquifer 1 groundwater outside the IRM barrier wall. Onsite discharge of treated groundwater to the Main Gravel Pit Lake or equivalent Aquifer 2 recharge system.
- Removal and offsite incineration of LNAPL from within and adjacent to the IRM for the purpose of immobilization of residual LNAPL
- Contingent venting of IRM soils. The effectiveness of the venting will be determined by treatability studies to be conducted during remedial design
- Contingent extraction and treatment of contaminated Aquifer 2 groundwater. Discharge of extracted ground water to Main Gravel Pit Lake or equivalent Aquifer 2 recharge system.

*For the Buried Drum Area (BDA):*

- Excavation of approximately 10,000 cubic yards of soil and debris from the BDA.
- Offsite treatment and disposal of the soils and debris with high levels of contamination at a permitted hazardous waste landfill.
- Placement of soil with low levels of contamination below an extension of the existing IRM cap.
- Backfilling of the uncontaminated soil.

*Site-wide actions:*

- Institutional controls
- Long-term groundwater and surface water monitoring

*Offsite Areas:*

- Long-term monitoring of private drinking water wells, with a contingency for providing an alternative water supply, should contaminants attributed to the site exceed MCLs at private wells.

#### **1.4 Performance Standards**

The Consent Decree specified performance standards for the remedial action which are outlined below.

*Vertical Barrier Wall*

A vertical barrier wall shall be installed that isolates from groundwater the IRM area and areas where LNAPL has been detected. The vertical barrier system should aid in restoration of Aquifer 1 outside the wall by minimizing migration of contamination from within the wall. The barrier wall shall be keyed into the aquifer system beneath Aquifer 1. The barrier wall has several performance requirements such as

- a maximum permeability of  $1 \times 10^{-7}$  cm/s,
- be continuous to not allow windows of higher permeability,
- barrier shall be stable and resistant to degradation from hydraulic permeation of the wall and from adjacent groundwater movement,
- maintain integrity and be physically stable under environmental loading conditions (seismic or dewatering),
- the barrier wall shall retain long-term physical integrity under possible chemical alteration resulting from quality of permeating groundwater and chemical COCs in the soils and groundwater incorporated into the backfill, and

- designed using a value engineering process.

#### *Cap Expansion*

- must be compatible with the existing cap and
- provide long-term minimization of migration of contaminants through the expanded IRM area
- function with minimum maintenance
- promote drainage and minimize erosion or abrasion of the cap
- accommodate settling and subsidence so that the cap's integrity is maintained
- expand the surface water drainage system to convey direct precipitation and runoff to Queen City Lake or main Gravel Pit Lake.

#### *Dewatering/Groundwater Treatment within IRM*

- Groundwater extraction shall be implemented in order to minimize discharge of contaminated water from the IRM through the Aquifer 1 aquitard system into Aquifer 2.
- Groundwater contained within the FCC shall be removed to the maximum extent possible
- Groundwater which may leak through the FCC into the isolated area shall be extracted on a long-term basis to minimize the mobility of residual contaminants within the FCC.

#### *LNAPL Immobilization*

The primary purpose is the reduction of volume, immobilization of source material and minimization of further contamination of Aquifer 2. The general performance standard is to minimize further contamination of Aquifer 2.

#### *Passive Venting*

The primary purpose of passive venting of IRM soils is additional volume reduction of the most mobile contaminants within the IRM soils. Treatability and feasibility testing is currently ongoing.

#### *Aquifer 1 Extraction and Treatment outside of IRM*

The primary cleanup objective for Aquifer 1 remediation is protection of Aquifer 2. The Consent Decree requires a statistical trend analysis of groundwater monitoring data which will form the basis for evaluating the necessity of implementing active aquifer restoration. If the trend analysis reveals that contaminant concentrations within Aquifer 1 will not achieve the  $1 \times 10^{-5}$  cumulative cancer risk within five years after construction of the vertical barrier wall, then extraction and treatment of Aquifer 1 may be implemented. Aquifer 1 is subject to the minimum performance standards shown in Table 1.

### *Aquifer 2 Extraction and Treatment*

The primary remedial objective of this element of the remedy is the onsite containment of the Aquifer 2 TCE plume. A long-term goal is restoration of Aquifer 2 to its beneficial use. If plume expansion is detected, groundwater extraction may be implemented to reduce the size of the plume. Evaluation of plume expansion will depend on expert knowledge of the groundwater system at the QCF site and statistical analysis of monitoring data from wells from which levels of contamination can be measured.

- A conditional point of compliance has been defined to horizontally encompass the  $10^{-5}$  cumulative risk concentration contour in Aquifer 2 (Figure 2).
- Aquifer 2 groundwater outside this conditional point of compliance must meet the Minimum Performance standards shown in Table 2.
- If a trend analysis reveals that contaminant concentrations in Aquifer 2 outside the conditional point of compliance will not achieve the  $10^{-5}$  cumulative risk level within 10 years, then extraction and treatment may be implemented
- Compliance with minimum performance standards must be documented at all monitoring wells outside the conditional point of compliance for at least eight consecutive quarters.

This report is focussed on groundwater and the effect of the vertical barrier wall construction on groundwater. Certain aspects of the requirements of the Consent Decree, such as soil quality within the BDA or construction quality of the barrier wall and cap, have been addressed by others and are beyond the scope of this report.

## 2 SITE CONCEPTUAL HYDROGEOLOGIC MODEL

### 2.1 Prior to FCC Construction

The site conceptual model of hydrogeology was previously developed by Landau (1992a) based on understanding of site conditions at that time. A summary is provided below to indicate the general framework for understanding how construction of the FCC would affect groundwater flow and contaminant transport. A schematic drawing of the conceptual hydrogeologic relationships is shown in Figure 3.

The groundwater system is comprised of five water-bearing zones. Nearest to the surface, the Near-Surface-Water-Bearing Zone (NSWBZ), composed of permeable outwash deposits underlain by a thick till. A locally continuous sand lens has been identified in the till. Adjacent to the NSWBZ, a perched aquifer (Aquifer 1) is present in highly permeable glacial deposits. Both of these two zones are contained within the borders of the QCF site and adjacent Cedar Hills Landfill.

Aquifer 1 is composed of highly permeable sands, gravels, cobbles and boulders which grade upward to finer-grained deposits. Open-work gravel is present in Aquifer 1 and is highly permeable (there were several "loss of slurry" events during construction of the barrier wall). Aquifer 1 is underlain by an aquitard system of till and clayey silt or silty sand.

Aquifer 1 is recharged by subsurface flow from the NSWBZ and Queen City Lake. Groundwater discharges from Aquifer 1 primarily through the leaky aquitard system downward and through springs (East Airstrip springs). Groundwater levels in Aquifer 1 have historically been affected by seasonal recharge from Queen City Lake, which historically dried up during summer months. Installation of a surface water diversion culvert in Queen City Lake during 1991 has limited the elevation of the lake and therefore reduced recharge to Aquifer 1.

An unsaturated zone 40 to 50 feet in thickness separates Aquifers 1 and 2.

Aquifer 2 consists primarily of fine to medium sand and silty sand with occasional discontinuous silty layers. The saturated thickness of Aquifer 2 is between 30 and 55 feet, being greatest during winter months. The upper portion of Aquifer 2 is more permeable than the lower portion consisting of Vashon outwash deposits. Aquifer 2 is believed to pinch out in the eastern portion of the site (Landau, 1992a). A groundwater mound occurs within the lower Aquifer 2 portion (referred to as Unit F) under Main Gravel Pit Lake due to recharge from the lake and the lower permeability compared to the upper portion. The mounding causes horizontal radial flow of groundwater and downward flow to Aquifer 3. Horizontal groundwater velocities in Unit F have been estimated to range between 10 to 100 feet per year and are likely higher in the upper portion of Aquifer 2.

Landau (1992b) point out that changes in the hydrogeology of Aquifer 2 have occurred in the recent past due to gravel mining and construction of erosion control measures. These changes have resulted in an increase in the saturated thickness of upper Aquifer 2 during the wet season, an increase in horizontal and vertical hydraulic gradients in Unit F portion and a southward shift in the location of the groundwater mound by an estimated distance of 500 – 1,000 ft.

Aquifer 3 is a confined aquifer and consists of deposits similar to the lower portion of Aquifer 2. Piezometric measurements indicate that groundwater flow in Aquifer 3 is relatively uniform and migrates from the northeast to the southwest. Vertical hydraulic gradients are downward from Aquifer 2 to Aquifer 3.



## 2.2 Expected Hydrogeologic Effects of Remedial Action

The primary remedial action goal for the FCC around the IRM area was to reduce the flow of groundwater through impacted subsurface soils and to aid in restoration of Aquifer 1 outside the barrier wall by containing COCs within the IRM area. Ultimately, constituent of concern concentrations in both Aquifer 1 and Aquifer 2 groundwater would be reduced.

Prior to construction, the expected response of the hydrogeologic system to the vertical barrier wall was evaluated in several studies. A summary of the main effects is described below.

*Disruption of flow in Aquifer 1* The barrier wall would affect groundwater flow patterns in Aquifer 1 and the underlying aquitard system. Landau (1992b) indicated that the barrier wall would decrease the available storage capacity of Aquifer 1 and could potentially increase wet-season piezometric levels. However, construction of drains in 1991 was expected to offset this effect. The sand lens within the glacial till which discharges to Aquifer 1 would also be susceptible to increased piezometric levels after barrier wall construction.

*Diversion of groundwater flow around northern barrier wall* Golder Associates (1994) modeled the build-up of hydraulic head within the sand lens along the north barrier wall and found that groundwater flow would be diverted to the west (Queen City Lake) and east around the barrier wall. A maximum additional head build-up within the sand lens of approximately 18 feet above existing conditions was anticipated. Kennedy/Jenks (1996) also evaluated this issue and concluded a maximum hydraulic head buildup behind the wall would be 35 feet of initial saturated thickness plus 12 feet of head build-up after construction. Potentiometric levels in the range of 460 and 465 feet above sea level (asl) were anticipated for wells P3, P8 and P5.

*Decline of groundwater levels inside the barrier walls* Groundwater levels within the barrier wall and cap were expected to decline to a steady-state level balancing flux in through the cap and barrier walls with flux out through the underlying aquitard and barrier walls. The maximum conservatively assumed hydraulic head difference across the barrier wall for the purpose of design was 47 feet across the northern wall (Kennedy/Jenks, 1994).

*Reduction in concentration levels in Aquifer 1* Diversion of groundwater around the barrier would minimize contact with contaminated soils and minimize contaminant flux to Aquifer 1 from the remediated zone. Therefore, contaminant concentrations would be expected to decline after construction of the barrier. Landau (1992b) estimated a period of 5 years or less would be required. Constituent concentrations in Aquifer 1 springs would be expected to also decline with time.

*Reduction in concentration levels in Aquifer 2* Isolation of the source material within the barrier wall and cap should reduce mass flux loading to Aquifer 2 due to a reduced downward hydraulic gradient within the FCC and improvement in Aquifer 1 groundwater quality. Since Aquifer 2 exhibits a radial pattern of groundwater flow due to recharge from Aquifer 1 and Main Gravel Pit Lake, at some point "cleaner" groundwater would be expected to begin migrating from the recharge area. Declines in concentration in Aquifer 2 groundwater were expected to occur after several years (2 to 5 years estimated by Landau, 1992b) due to the time required to migrate through the unsaturated zone. An indication of the rate of Aquifer 2 restoration should be available within 10 years (Landau 1992b). Declines in concentration should occur within the upper portion of Aquifer 2 before the lower portions of the aquifer.

Landau (1992b) also indicated that long-term southerly expansion of the Aquifer 2 plume is not expected to occur once source control by the barrier and cap is implemented, but the plume could expand to the north in the short-term. Restoration processes were expected to be slower in the northern portion of the plume since that area receives less recharge and is overlain by relatively impermeable till.

### 3 METHODOLOGY

#### 3.1 Source of Monitoring Data

Monitoring data has been collected on a regular basis by The Boeing Company and published in annual monitoring data reports prepared by EcoChem, Inc. of Seattle, WA. The monitoring plan as defined in the Consent Decree is shown in Table 3, and monitoring locations are shown on Figure 4. For the purposes of this assessment, data collected during the period 1994 to 1999 was evaluated (EcoChem 1995, 1996, 1997, 1998, 1999a,b,c,d,e). This allowed the assessment to compare results obtained before the vertical wall barrier construction with data collected after construction.

#### 3.2 Graphical Time-Series Trend Analyses

In order to ascertain trends in concentration at a particular monitoring well, time-series plots of monitoring data were prepared. This graphical technique was intended to provide a visual assessment of concentration changes of COCs in groundwater, both prior to and following the construction of the vertical barrier, and to indicate whether other processes may have an impact on concentration.

Plots were prepared for the period January 1 1994 through December 31 1999. This allowed observation of concentration trends prior to construction of the vertical barrier wall which was effectively completed in September 1996 (Kennedy/Jenks Consultants, 1998) and the post-construction response. In order to provide a gross estimate of the time required for concentration trends to reach the performance standard, a linear regression of post-construction data was performed.

#### 3.3 Statistical Analyses

As required by the Consent Decree, a statistical analysis of constituent concentrations was performed to determine trend and also to assess compliance. The statistical analyses are intended to form the basis for evaluating the necessity of implementing active aquifer restoration such as groundwater extraction and treatment. According to the Consent Decree such remedial action *may be required* if the following conditions are not met based on the statistical analysis:

- Aquifer 1 risk level is reduced below  $1 \times 10^{-5}$  within five (5) years after construction of the vertical barrier,
- Aquifer 1 concentrations of COCs in groundwater are predicted to be less than the performance standards,
- In Aquifer 2, the 5 µg/L TCE plume boundary is decreasing or stable,
- In Aquifer 2, constituent concentrations outside the conditional point of compliance achieve the  $1 \times 10^{-5}$  cumulative cancer risk within ten (10) years after construction of the vertical barrier.

The statistical methods employed in this report are described in the following sections. Statistical methods have been selected which are consistent with published USEPA and WA Department of Ecology guidance (USEPA, 1989, Ecology, 1992), and are also consistent with WAC 173-340-720.

The following general approach was used in the analysis:

- The distribution type of the data (i.e. normal or lognormal ) was determined so that statistical methods were appropriate for the data
- Compliance with groundwater cleanup performance standards and action levels was determined for each monitoring well
- For purposes of demonstrating compliance, measurements below the detection limit were assigned as one-half of the method detection limit.
- A confidence interval approach was used to test compliance. The upper confidence limit (UCL) was determined for a Type I error level of 0.05 (i.e. 95% confidence limit).
- Monitoring concentration data was divided into three groups for analysis:
  - pre-construction (before September 1996),
  - post-construction (after September 1996), and
  - previous eight (8) quarters (1998 and 1999 data)

The software program *MTCASat* ( Ecology, 1998) was used to perform statistical calculations of the groundwater concentration data. This code enabled rapid and consistent calculation of the data statistical parameters. The results are shown in Appendix E.

**Normality Testing** The distribution of the data was determined using the probability plot method and/or the W test. In cases where the distribution of the data could not be determined, it was assumed to be lognormal.

**Calculation of Upper Confidence Limit** The default assumption was that the data come from a lognormal distribution. In some cases, the number of non-detected (censored) measurements influenced the procedure. When less than 15% of data were censored, non-detected samples were replaced with one-half of the detection limit. If more than 15% but less than 50% of data were censored, Cohen's method (Gilbert, 1987) was used to calculate the UCL when censored data was included. If more than 50% of the data were censored, the largest value in the data set was used as the UCL.

**Test for Trend** The Mann-Kendall method (Gilbert, 1987) was used to determine whether a significant trend in concentration data was present. This method is a non-parametric test which computes a statistic (S) that tests the null hypothesis that there is no trend for a specified level of significance. For a time-ordered list of data, the Mann-Kendall statistic calculates the differences between measurements later in time with earlier ones. Essentially, the number of positive differences are subtracted from the number of negative differences. Therefore, a large negative value of S indicates that measurements later in time tend to be smaller, or a decreasing trend. S values were calculated and compared to probability values for a 0.05 level of significance.

### 3.4 Compliance Assessment

In order for groundwater to be in compliance, the data must meet the following conditions:

- the 95% upper confidence limit (UCL) must be less than the performance standard, and,
- no single sample in the previous eight consecutive quarters shall be more than two times the performance standard, and,
- less than 10% of samples shall not exceed the performance standard for the sampling period.

The performance standards are shown in Tables 1 and 2.

## 4 DISCUSSION OF RESULTS AND TRENDS

### 4.1 Aquifer 1

#### 4.1.1 Groundwater Levels

A comparative plot of groundwater levels in Aquifer 1 through the period 1994-1999 are shown on Figure 5. The two plots of Aquifer 1 water levels indicate the general groundwater level and hydraulic gradient trends for this system. The general elevation relationships shown in Figure 5 confirm the conceptual pattern of groundwater flow: southward and downward flow from the area north of the remedial area, and recharge from Queen City Lake into the remediated and non-remediated portions of Aquifer 1. Seasonal changes in the level of Queen City lake can also be clearly seen.

Prior to installation of the vertical barrier, Aquifer 1 water levels behaved in a regular manner exhibiting seasonal fluctuations. Highest water levels occurred during the winter months, rising dramatically in October, peaking in December/January and decaying to minimum values during September. This trend occurred both within and outside the area later contained by the barrier. A seasonal change in level of 6 to 8 feet occurred in Aquifer 1 during 1995. This generally corresponds with monthly precipitation as shown in Figure 6, indicating that Aquifer 1 responded to recharge from precipitation prior to barrier construction.

Following completion of the slurry wall in September 1996<sup>1</sup>, it is clear from Figure 5 that the water levels of wells located within the barrier dramatically changed their pattern of behavior. A detailed plot of water levels obtained from transducer data is shown in Figure 7. Water level at MW-5, MW-6, MW-7, X-5 and B-1 all indicate a steady decline in water level after construction. Well B-1 declined and went dry in early 1998 once water levels dropped below the bottom of the well screen. Levels in MW-5 and MW-6 declined to elevation 410 and 413 ft asl, respectively. The level at X-5 declined to an elevation of 403.7 ft on 10 February 2000. These elevations correspond to the approximate elevation of the aquitard underlying Aquifer 1, indicating that the aquifer within the slurry wall has essentially been dewatered. Seasonal response to precipitation by wells within the slurry wall ceased with construction of the slurry wall.

Water levels in the sand lens on the north side of the FCC have shown a slight increase in level since construction, having risen only 1 to 2 feet since construction ended. This indicates that potential conditions identified during design regarding excessive head buildup and possible piping or blow-out of the slurry wall have not occurred. It also indicates that the potential for the north sand lens to divert groundwater around the FCC is greater than anticipated.

In contrast to water levels within the barrier, water levels at E-1 and Z-1 which are south and west of the FCC, continue to indicate a seasonal fluctuation after construction. These two wells indicate a slightly lower amplitude of fluctuation than prior to construction, but the general seasonal trend is apparent.

<sup>1</sup> See Golder Associates Inc. (1997) and Kennedy /Jenks (1998) for details of FCC construction

The level of Queen City Lake has also been affected somewhat by construction of the slurry wall. Although still exhibiting seasonal changes in water level, the amplitude of change and rate of change in level appears to have lessened following barrier construction.

The observed water level data and the relative monitoring locations indicates that the construction of the slurry barrier wall has resulted in significant changes to groundwater flow in Aquifer 1. The rapid and immediate decline in water levels and dewatering of Aquifer 1 within the barrier indicates that groundwater flow has been disrupted and diverted around the barrier. Recharge from Queen City Lake has been minimized since the water level at well B-1, which is inside the wall and in close proximity to the lake, has declined to the level of the aquitard. The total flux of groundwater through the slurry wall from all sides and the cap (i.e. inward) must have been reduced to the point that the flux downward through the aquitard (i.e. out) was much greater than the inward flux.

#### 4.1.2 Groundwater Quality

Time-series plots of COCs from each well in Aquifer 1 are shown in Appendix A. A summary of the statistical analysis for each well is presented in Table 4.

##### *Inside Barrier*

Monitoring of groundwater quality inside the vertical barrier wall has indicated that constituent concentrations have generally remained at elevated levels. Natural dewatering has occurred and all monitoring wells are now dry. The last data collected (EcoChem, 1999 b,c,d,e) indicate that two samplings of Well X-5 contained the following COCs which exceed the Aquifer 1 minimum performance standards:

Chromium:	799 and 1130 µg/L
PCBs:	Arochlor 1260 detected at 1500 and 670 µg/L
Carcinogenic PAHs:	all PAH compounds exceeded the 1 µg/L standard except one analysis for Indeno(1,2,3-cd)pyrene
Trichloroethene (TCE):	11 µg/L, in April 1999 sample
cis-1,2- Dichloroethene (cDCE):	92 and 104 µg/L
Vinyl Chloride (VC):	7.2 µg/L in April 1999 sample.

Data obtained from MW-6 before it went dry in 1998, indicated that concentrations of chlorinated solvents (TCE, cDCE, vinyl chloride) and chromium were well above the minimum performance standards. There is limited data available to assess the trends in concentrations within the vertical barrier area, however data from MW-6 obtained during 1997 and 1998 suggests that construction of the barrier had little effect on constituent concentrations. A visual evaluation of the concentration versus time data in Appendix A suggests that concentrations have wide variability.

### *Outside Barrier*

Data collected from wells E-1, E-1a and Z-1 indicate that significant improvements in groundwater quality outside the barrier have occurred since construction of the slurry wall. The concentration of chlorinated solvents and chromium show large declines in concentration and reduced variability during the post-construction period. The concentration of chromium, vinyl chloride, cDCE and TCE declined to acceptable levels immediately following construction of the barrier (Appendix A) except for one anomalous value of chromium in September 1998 (619 µg/L in well E-1a). The seasonal variation in chromium concentration at well E-1 continued following construction but the magnitude of concentration change is much reduced. A statistical summary of concentration changes in Aquifer 1 is shown in Table 4.

### *Springs*

Two springs have been monitored which drain Aquifer 1: SP-5 southeast of the IRM on the gravel pit face, and EC-2 south of Queen City Lake on the gravel pit face. Plots of concentration versus time for EC-2 and SP-5 are shown in Appendix B and a summary of concentration changes for key COCs is shown in Table 5.

Prior to the barrier wall construction, EC-2 contained concentrations of TCE and VC which exceeded the Aquifer 1 performance standards. Cis-dichloroethene and chromium were also present at detectable concentrations, but the 95% UCL for these COCs were less than one half of the performance standard. Following construction, it is apparent that the mean, maximum and UCL values all declined significantly. As shown in Table 5, chromium, trichloroethene, Cis-dichloroethene and vinyl chloride at EC-2 meet compliance criteria for the Aquifer 1 performance standards. EcoChem (1999a-e) also indicate that other site COCs are not present above the method detect limits.

Monitoring data for SP-5 prior to the barrier wall construction is limited to two samples based on flow of the spring, and post-construction monitoring became semi-annual in 1997 (Table 5). Following construction, the concentration of TCE has indicated a declining trend but the UCL of 10.3 µg/L is twice the standard. The concentration of chromium has been highly variable following construction and although appears to have a slight declining trend, it is not statistically significant. Both chromium and TCE exceed the performance standards at SP-5 (the TCE exceedance due to a single elevated value), but the presence of cDCE and vinyl chloride have not been detected since October 1997.

## **4.2 Aquifer 2**

### **4.2.1 Groundwater Levels**

It was anticipated that construction of the barrier would have a limited effect on groundwater levels in Aquifer 2. However, increased recharge from Main Gravel Pit Lake (MGPL) due to altered surface water drainage is part of the site conceptual model (Landau, 1992b). EcoChem (1995 to 1999a) report relatively consistent potentiometric surfaces for Aquifer 2 in terms of general flow direction, and a radial flow pattern away from the area of Gravel Pit Lake.

A plot of water levels in Aquifer 2 between 1994 and 1999 provides a general indication of only subtle effects due to slurry wall construction. Figure 8 shows groundwater levels near MGPL.



Levels in the aquifer are less than the lake and there is a strong correlation between levels in MGPL and Aquifer 2. Water levels in the lake peak during winter months and vary seasonally approximately 10 and 15 feet. A similar relationship is seen in Figure 8 for Aquifer 2 levels near the remediated area.

It is noted that for both areas, increasing the level of MGPL results in increased aquifer levels. It is also noted that during the winter of 1996-97 following construction, the level of MGPL increased considerably and did not go dry during the following summer. Aquifer 2 levels also increased more than the previous winters. This occurred even though the amount of precipitation was not significantly greater than the previous winter (Figure 6). This suggests that with the construction of the vertical barrier, cap, and the surface water drainage systems, an increased volume of water was diverted to MGPL and hence the aquifer.

Inspection of Aquifer 2 potentiometric maps for April and October 1999 (Figures 9 & 10) confirm the seasonal fluctuation and role of recharge from MGPL and the gravel pit area. It is also evident that recharge to Aquifer 2 creates a large relatively flat-lying mound area (e.g. elevation contour 361 ft, Figure 9) which extends from the MGPL northwesterly to a point near well A2. Following the dry season, the mound declines but occupies a similar sized area (e.g. elevation contour 353 ft, Figure 10). During 1999 groundwater levels within the mound area fluctuated approximately 8 feet but levels outside the mound area fluctuated much less.

The aquifer 2 potentiometric maps also indicate high groundwater potential east of the FCC in the vicinity of K2 and T2. Aquifer 2 in this area actually thins and pinches out, so the water levels in these two wells reflect levels in surrounding fine-grained layers rather than Aquifer 2. The effect of the thinning of Aquifer 2 in this area is that groundwater flow will be diverted from this area and TCE would not be expected to migrate significantly in an easterly direction. The recharge mound that developed in 1999 occupies a substantially larger area than pre-construction conditions<sup>2</sup>. This is consistent with an increased volume of recharge to Aquifer 2.

#### 4.2.2 Groundwater Quality

The primary COCs in Aquifer 2 are the chlorinated ethenes and their degradation products. The goal is to meet performance standards at the conditional point of compliance and to ensure that groundwater meets the performance standard at the property boundary.

Plots of concentration versus time have been prepared for graphical analysis of trends for each monitor well, and are contained in Appendix C for upper Aquifer 2 and Appendix D for lower Aquifer 2. The basic statistical summary of changes in TCE concentration before and after barrier construction are shown in Tables 6 and 7. Data has been categorized as "*Pre-construction*", which was prior to 5 September 1996, "*Post-construction*", and for the purposes of compliance evaluation "*Last Eight Quarters*", which includes quarterly monitoring data obtained during 1998 and 1999.

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<sup>2</sup> See Figures 3-21 and 3-22 of Supplemental Remedial Investigation Report, Landau Associates (1992).

*Upper Aquifer 2*

TCE is the only constituent of concern which exceeds the standard in upper Aquifer 2. The maximum concentration of TCE in upper Aquifer 2 occurs at well E2a (maximum 58 µg/L during last eight quarters). Concentrations generally decline with distance from the FCC.

A summary of where TCE is present above or below the performance standard is shown below.

	<u>TCE below standard</u>	<u>TCE above standard</u>
FCC Area:	F2a <sup>*</sup> ,	C2a <sup>*</sup> , E2a <sup>*</sup> , G2a <sup>*</sup>
West Perimeter:	D2a, R2a	--
South Perimeter:	H2a, I2a <sup>*</sup> , M2a, N2a, O2a, S2a	--
East Perimeter:	K2a	--
North Perimeter:	J2a	L2a, V2a

\* wells within conditional point of compliance

Of the five wells where TCE has been detected, L2a and V2a are located close to the site's downgradient northern property boundary and have TCE concentrations which remain approximately twice the MCL value. TCE concentrations in L2a appear to be influenced by seasonality, peaking in winter, although there is a slight downward trend. Wells closer to the remediated source area (C2a, E2a, G2a) display distinct statistical decreases in TCE concentration following construction of the vertical barrier wall system.

Wells C2a, G2a and F2a were installed for the purpose of monitoring the effectiveness of the remedy, including the FCC. Of these, only Well F2a is in compliance, and has shown no significant trend. TCE concentration in groundwater at Wells C2a and G2a have UCL values of 28.8 µg/L and 7.8 µg/L, respectively for the 1998-99 period with a decreasing trend. According to Landau (1992b) approximately two to five years would be required for contaminant transport through the vadose zone, so there may not have been enough time for the full effects of the FCC to appear in Aquifer 2. However, based on the data which are available at this time, groundwater near the FCC has either decreased in TCE concentration or remained in compliance. This indicates that the FCC is performing as expected. These data also confirm previous observations that the apparent central source area of TCE is primarily in the southwesterly portion of the remediated area.

Based on monitoring results to date, it is concluded that TCE impact on upper Aquifer 2 has generally declined since construction of the barrier wall system. However, groundwater which exceeds the performance standards still exists in the vicinity of the remediated area and at the northern property boundary. The monitoring data indicates that groundwater to the west, south and east perimeters in upper Aquifer 2 meet the performance standards. A visual summary of TCE trends through time for the upper Aquifer 2 is shown in Figure 11 which depicts mean annual TCE concentration versus time. A trend analysis of these data (Table 8 ) indicates that TCE within the conditional point of compliance area is declining at some wells or has no trend at others. Some

wells outside of the conditional point of compliance have not detected TCE, while others contain TCE that is declining or has no statistically significant trend.

#### *Lower Aquifer 2*

TCE is the only constituent of concern which exceeds the standard in lower Aquifer 2. The maximum concentration of TCE in lower Aquifer 2 during the last eight quarters occurred at well E2 (maximum 93 µg/L in October 1999). Concentrations in this aquifer decline with distance from the source area, but TCE has spread further from the source than compared to upper Aquifer 2.

A snapshot distribution of TCE within lower Aquifer 2 during October 1999 is shown on Figure 12. The distribution of the TCE plume is consistent with previous representations (Figure 2). and does not appear to be increasing in area. This is supported by plots of mean annual TCE concentration versus time shown in Figure 13. Overall, TCE concentrations appear to have declined or remained stable. A trend analysis of mean annual TCE values in lower Aquifer 2 (Table 9) also indicates that trends are declining or are not statistically significant either inside or outside the conditional point of compliance. The observed data patterns for those wells closest to the apparent source area (e.g. B2, F2, E2) have declined somewhat or have no trend. The rate of change in concentration appears to be gradual and there is not a discernible change in trend associated with FCC construction

A summary of where TCE has been detected above the standard is shown below.

	<u>TCE below standard</u>	<u>TCE above standard</u>
Plume Area:	none	B2*, C2*, E2*, F2*, G2*, I2*, L2
West Perimeter:	A2, D2, R2	--
South Perimeter:	H2, N2, O2, S2, T2, U2	--
East Perimeter:	K2	M2
North Perimeter:	J2	

\* wells within conditional point of compliance

For the eight wells which contain elevated TCE concentrations, five wells indicate significantly decreasing trends (B2, F2, I2, L2, M2), one well has an increasing trend (C2), two have no significant trend (E2, G2). A linear regression analysis of post-construction TCE versus date plots was performed for wells where TCE was detected (Table 9). This analysis fits a linear curve to the data and determines a slope (m) and y-axis intercept (b) for the line (of the form  $y = mx + b$ ). In order to determine the time required to meet the TCE standard, the ordinate value (y) was set to 5 µg/L and the linear equation was solved for the equivalent date number (or x-axis value). The elapsed time to reach the standard was calculated by subtracting the date number for end of construction from the date number when TCE reached the standard.

As shown in Table 10, the time required to reach the standard range from 1 to 62 years following construction. However, these time estimates should serve only as an indication of the magnitude of time required. This is because the analysis assumes a linear relationship and it is clear from the low regression coefficient values ( $R^2$ ) that many data have a low degree of linearity.

The only location outside the conditional point of compliance where the regression analysis indicates that considerably longer time periods than 10 years would be required to reach the performance standard was L2. All of the other locations outside of the conditional point of compliance suggest a downward trend and based on the linear regression would reach the TCE standard within 10 years after construction. Closer inspection of TCE concentration at L2 (Appendix D, Table 7) indicates that concentrations have historically been seasonally affected and have not changed significantly through time. The TCE plume in this northern area appears to have reached a near-stable condition.

### 4.3 Evaluation Summary

#### *Aquifer 1*

It is a requirement to show that contaminant concentrations within Aquifer 1 outside the FCC achieve the performance standards within 5 years after construction. Review of the available data indicates that dramatic changes in quality have been achieved outside of the barrier since construction. Groundwater quality inside the barrier remains well above the performance standards.

Monitoring at E1, E1a, Z1 and EC-2 (spring) in the western portion of Aquifer 1 has indicated that TCE, cDCE, and VC have all declined to acceptable levels since the barrier was constructed. With the exception of one anomalously high concentration of chromium in one sample from E1a in October 1998, chromium has also declined to below the performance standard for this zone. Other COCs have not been detected in Aquifer 1 outside of the barrier in the last eight quarters. This indicates that the barrier is effectively containing COCs.

However, the quality of groundwater in the eastern portion of Aquifer 1 (spring SP-5) exceeds the performance standards for TCE and chromium. This is likely due to the proximity to the source area and the minimal infiltration and flushing that now occurs in this portion of the site. TCE has a statistically strong declining trend, and the apparent exceedance by the UCL of the standard is dominated by one sample collected in November 1996. TCE had been less than 5 µg/L since then. Chromium has an apparent declining trend which is not statistically significant, but a linear regression of post-construction data suggests that the standard will be met 4 years after construction (year 2000). Therefore, the quality of Aquifer 1 should continue to improve and appears likely to meet the performance standards within the 5 year post-construction period.

The response of Aquifer 1 groundwater levels and improvements in quality indicate that the barrier has performed in an effective manner as it was designed to do.

#### *Aquifer 2*

Monitoring data has indicated that the TCE plume, as determined by the 5 µg/L concentration isopleth, has remained relatively stable for several years. Overall, TCE concentrations have declined or have no trend since barrier construction.

TCE concentrations of the plume at wells outside of the conditional point of compliance show declining trends or non-detectable TCE. All wells outside the point of compliance to the east, south and west can be considered to be either: a) in compliance with the standard for upper and lower Aquifer 2; or b) declining at a rate that would meet the standard within approximately 10 years. The northern perimeter of the plume appears near-stable at L2 and may require more than 10 years to be restored to the performance standard. In addition, it is not predicted to exceed the cumulative risk action level ( $1 \times 10^{-5}$ ) that would trigger groundwater extraction and treatment.

Within the conditional point of compliance, TCE concentrations are generally declining or have no trend. Only location C2 has indicated an increasing trend since barrier construction. However, it is likely that the effects of the FCC construction have not fully manifested themselves throughout the groundwater system, and further time is required to confirm this.

## 5 CONCLUSIONS

Based on the available monitoring data and the analysis that has been performed, the following conclusions have been drawn.

- Construction of the FCC has resulted in disruption of groundwater flow in Aquifer 1 causing diversion of flow around the barrier wall and a rapid dewatering of the aquifer within the FCC.
- Construction of the FCC has resulted in significant and rapid improvements in groundwater quality in Aquifer 1 outside of the FCC. Groundwater in Aquifer 1 is expected to meet the performance standards within 5 years of construction. E1a and SP-5 are the two locations which have not yet met the performance standard.
- Changes to groundwater flow in Aquifer 1 has resulted in an apparent increase in the seasonal level of Gravel Pit Lake and recharge of water to Aquifer 2. This has resulted in groundwater mounding occupying a larger area in Aquifer 2.
- TCE is the only constituent of concern in Aquifer 2 which occurs above the performance standards.
- The distribution and area of the TCE plume in 1999 remained similar to that observed in previous years.
- TCE concentrations in Aquifer 2 outside of the conditional point of compliance show either declining or no trends. All wells in Aquifer 2 to the east, south and west outside of the conditional point of compliance meet the performance standard, or are declining at a rate that will meet the standard within approximately 10 years. Groundwater at well L2 near the north perimeter contains elevated TCE, has a declining trend but may require a few decades to reach the performance standard. There has been no observed effect of COCs migrating from inside the FCC to wells outside the conditional point of compliance.
- The observed response of the hydrogeologic system to construction of the final containment cell leads to the conclusion that the FCC is performing as designed.

## 6 CLOSURE

This report has been prepared to provide a preliminary evaluation of the performance of the Final Containment Cell at the Queen City Farms site. It has been necessary to rely on data and information provided by others. In the event that additional relevant information becomes available, the interpretation and conclusions may need to be reconsidered. Should there be any clarification required regarding this report, and its conclusions, please contact the undersigned.

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Table 1 Aquifer 1 Minimum Performance Standards

Constituent	Concentration (µg/L)	Basis	Risk Level
Chromium (total)	80	ROD	HI = 1(non-cancer)
PCB (total)	0.5	MCL	$4.4 \times 10^{-5}$ (cancer)
Carcinogenic PAH	1	--	$1 \times 10^{-4}$
Tetrachloroethene	5	MCL	$5 \times 10^{-6}$
Trichloroethene	5	ROD/MCL	$2 \times 10^{-6}$
1,2-Dichloroethene (cis)	70	ROD/MCL	HI = 0.2
1,2-Dichloroethene (trans)	100	ROD/MCL	HI = 0.1
Vinyl Chloride	2	MCL	$1 \times 10^{-4}$

Aquifer 1 Adjusted Performance Standards

Constituent	Concentration (µg/L)	Basis	Risk Level
PCB (total)	0.01 <sup>a</sup>	ROD / MTCA	$1 \times 10^{-6}$
Carcinogenic PAH	0.01 <sup>a</sup>	ROD / MTCA	$1 \times 10^{-6}$
Tetrachloroethene	1	ROD / MTCA	$1 \times 10^{-6}$
Vinyl Chloride	0.02 <sup>a</sup>	ROD / MTCA	$1 \times 10^{-6}$

Notes:

(µg/L) is micrograms per liter

HI is Hazard Index

ROD is Record of Decision

MCL is Maximum Contaminant Level set under the Safe Drinking Water Act, 40 CFR part 141

MTCA is Washington State Model Toxics Control Act Method B, WAC 173-340-720

(a) these levels may be below the Practical Quantitation Limit. The Settling Defendant shall not be required to achieve analytical detection limits below EPA's Practical Quantitation Limits

Table 2 Aquifer 2 Minimum Performance Standards

Constituent	Concentration ( $\mu\text{g/L}$ )	Basis	Risk Level
Tetrachloroethene	5	MCL	$5 \times 10^{-6}$ (cancer)
Trichloroethene	5	ROD/MCL	$2 \times 10^{-6}$ (cancer)
1,2-Dichloroethene (cis)	70	ROD/MCL	HI = 0.2 (non-cancer)
1,2-Dichloroethene (trans)	100	ROD/MCL	HI = 0.1 (non-cancer)
Vinyl Chloride	2	MCL	$1 \times 10^{-4}$ (cancer)

Aquifer 2 Adjusted Performance Standards

Constituent	Concentration ( $\mu\text{g/L}$ )	Basis	Risk Level
Tetrachloroethene	1	ROD / MTCA	$1 \times 10^{-6}$
Vinyl Chloride	0.02 <sup>a</sup>	ROD / MTCA	$1 \times 10^{-6}$

Notes:

( $\mu\text{g/L}$ ) is micrograms per liter

HI is Hazard Index

ROD is Record of Decision

MCL is Maximum Contaminant Level set under the Safe Drinking Water Act, 40 CFR part 141

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(a) these levels may be below the Practical Quantitation Limit. The Settling Defendant shall not be required to achieve analytical detection limits below EPA's Practical Quantitation Limits

Table 3 Queen City Farms Consent Decree Monitoring Plan

Monitoring Location	Monitoring Purpose	Wells or Surface Water Sampling Location	Analytes	Frequency	Duration
IRM	Groundwater Quality	3 Wells <sup>a</sup>	VOC	Semiannually	(b)
Springs	Aquifer 1 Restoration	SP-5, EC-2, SP-4b	VOC, PCB, PAHs, Cr	Semiannually	(c)
Aquifer 1 Outside The IRM Area	Aquifer 1 Restoration	E1, E1a, Y1, Y1a, Z1, Z1a	VOC, PCB, PAH, Cr	Quarterly	(c)
Upper Aquifer 2	Plume	E2a, F2a, G2a, I2a, L2a	VOC	Quarterly	(b)
	Perimeter	D2a, J2a, K2a, N2a, O2a, P2a, R2a, S2a, T2a, V2a	VOC	Quarterly <sup>d</sup>	(b)
	Barrier System Effectiveness	F2a, G2a, C2a	VOC	Quarterly	(b)
Lower Aquifer 2	Plume	B2, C2, E2, F2, G2, I2, L2, M2, U2	VOC	Quarterly	(b)
	Perimeter	A2, D2, H2, J2, K2, N2, O2, P2, R2, S2, MW-57, MW-60, MW-XX	VOC	Quarterly <sup>d</sup>	(b)
Aquifer 3	Vertical Limit	B3, D3, H3, I3, MW-59	VOC	Annually	(b)
Offsite Wells	Offsite Impact		VOC <sup>f</sup>	Semiannually	15 years

Notes

- (a) to be specified after IRM dewatering
- (b) Monitoring until 3 years after completion of barrier system, then re-evaluate the frequency and duration
- (c) VOC will be monitored until 3 years after completion of the barrier system, then re-evaluated. PCB and PAH and Chromium will be monitored quarterly for 1 year. After 1 year, the monitoring requirement for these constituents will be re-evaluated
- (d) Quarterly for first year, then semiannual if no detects
- (e) Annually unless detects, then quarterly
- (f) All values above the laboratory detection limit will be confirmed by resampling within 15 days of receipt of written notice from the laboratory.

Table 4 Summary of concentration changes in Aquifer 1.

Station		Pre-Construction 1994-1996				Post-Construction 1996-1999				Previous Eight Quarters 1998-1999				Comments
	Performance Standard	TCE	cDCE	VC	Cr	TCE	cDCE	VC	Cr	TCE	cDCE	VC	Cr	
B1	No. of Samples	18	18	18	8	3	3	3	3	No Data				<ul style="list-style-type: none"> <li>- Inside barrier</li> <li>- dry in mid-1997</li> <li>- apparent declines, but inconclusive</li> <li>- remain above compliance levels</li> </ul>
	No. of Detections	18	18	16	8	3	3	3	3					
	Mean	23.1	33.9	5.5	82.7	11.5	38.3	7.2	53.2					
	Standard Deviation	9.8	17.1	4.1	23.7	2.6	14.0	1.5	12.0					
	Maximum	49	73	10.	124	13	52	8.4	67.					
	Distribution Type	Log	Norm	Log <sup>1</sup>	Log	Log <sup>1</sup>	Log	Log	Log					
	Upper Confidence Limit	28.7	40.9	13.1	101.3	21.95	162.1	12.4	89.8					
	W Statistic	0.964	0.978	NA	0.831	0.767	0.979	0.916	0.789					
E1	No. of Samples	19	19	18	9	13	13	13	13	8	8	8	8	<ul style="list-style-type: none"> <li>- outside barrier</li> <li>- significant declines after construction (<math>S_{TCE} = -32</math>)</li> <li>- in compliance for past 8 quarters</li> </ul>
	No. of Detections	19	19	14	8	2	12	8	12	0	7	4	7	
	Mean	8.8	78.8	7.9	92.5	0.35	1.93	0.94	38.1	ND	1.67	1.13	30.5	
	Standard Deviation	8.7	79.7	5.1	131.7	0.21	1.24	0.597	28.0		1.1	0.74	14.6	
	Maximum	30	270	19	367	0.5	4.7	2.0	118		3.5	2.0	49	
	Distribution Type	Log	Log	Norm	Log	NA	Log	Log	Log		Log	Log	Log	
	Upper Confidence Limit	16.21	313.	8.2	339.7	0.5	3.37	1.4	52.9		4	3.2	45.5	
	W Statistic	0.933	0.929	NA	0.804	NA	NA	NA	NA		NA	NA	NA	
E1a	No. of Samples	8	8	8	8	13	13	13	13	8	8	8	8	<ul style="list-style-type: none"> <li>- outside barrier</li> <li>- strong declining trend after construction (<math>S_{TCE} = -22</math>)</li> </ul>
	No. of Detections	8	8	4	8	5	7	1	7	1	4	1	5	
	Mean	19.6	102.6	4.8	938.	0.52	2.1	NA	99.3	0.8	3.4	NA	134.5	
	Standard Deviation	13.1	74.1	4.35	2125	0.26	2.2	NA	229.	NA	2.2	NA	271.	
	Maximum	39	250.	11.	6180.	0.8	5.4	1.0	619.	0.8	5.4	1.0	619.	
	Distribution Type	Log	Log	Log	Log	Norm	Log <sup>1</sup>	NA	Log <sup>1</sup>	NA	NA	NA	Log <sup>1</sup>	
	Upper Confidence Limit	48.3	340.	819.	75500	0.8	9.8	NA	348.	0.8	2.9	NA	12680	
	W Statistic	0.946	0.941	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

## Notes:

1. All concentrations in  $\mu\text{g/L}$
2. Log - Lognormal, Norm - Normal
3. <sup>1</sup> Indicates distribution type was assumed
4. NA - Not Applicable

Table 4 continued

	Station	Pre-Construction 1994-1996				Post-Construction 1996-1999				Previous Eight Quarters 1998-1999				Comments
		TCE	cDCE	VC	Cr	TCE	cDCE	VC	Cr	TCE	cDCE	VC	Cr	
	Performance Standard	5	70	2	80	5	70	2	80	5	70	2	80	
Z-1	No. of Samples	8	8	8	8	10	10	10	10	5	5	5	5	-
	No. of Detections	0	0	0	3	0	0	0	2	0	0	0	1	
	Mean	ND	ND	ND	64.4	ND	ND	ND	7.5	ND	ND	ND	7.3	
	Standard Deviation				70.8				0.28				NA	
	Maximum				146				7.7				7.3	
	Distribution Type				Log <sup>1</sup>				Log <sup>1</sup>				NA	
	Upper Confidence Limit				146				7.7				7.3	
	W Statistic				NA				NA				NA	
MW-6	No. of Samples	1	1	1	0	4	4	4	4	2	2	2	2	- Inside barrier - well dry in 1998 - apparent upward trend - all above standard
	No. of Detections	1	1	1		4	4	4	4	2	2	2	2	
	Mean	140	520	28		644	1112.	57.8	20913	897	1264.	72.5	35450	
	Standard Deviation	NA	NA	NA		395	449.8	33.2	26900	51.6	475.	16.3	36133	
	Maximum	140	520	28		933	1600.	84	61000	933.	1600.	84.	61000	
	Distribution Type	NA	NA	NA		Norm	Log	Norm	Log	NA	NA	NA	NA	
	Upper Confidence Limit	NA	NA	NA		1109.	2772	96.9	7.3E6	NA	NA	NA	NA	
	W Statistic	NA	NA	NA		0.818	0.954	0.860	NA	NA	NA	NA	NA	

## Notes:

5. All concentrations in µg/L
6. Log - Lognormal, Norm - Normal
7. <sup>1</sup> Indicates distribution type was assumed
8. NA - Not Applicable

Table 5 Summary of concentration changes in springs.

Station		Pre-Construction 1994-1996				Post-Construction 1996-1999				Comments
	Performance Standard	TCE	cDCE	VC	Cr	TCE	cDCE	VC	Cr	
		5	70	2	80	5	70	2	80	
SP-5	No. of Samples	2	2	2	2	9	9	9	7	- TCE declining ( $S_{TCE} = -24$ )
	No. of Detections	2	0	2	2	7	2	0	7	- apparent decreasing trend in Cr concentrations after construction but trend is not significant ( $S_{Cr} = -7$ )
	Mean	1.55	ND	0.46	<b>99.9</b>	3.10	0.25	ND	<b>149.9</b>	-
	Standard Deviation	0.50		0.05	24.2	2.28	0.07		83.6	
	Maximum	1.9		0.5	<b>117.</b>	<b>8.1</b>	0.3		<b>253.</b>	
	Distribution Type	NA		NA	NA	Log	NA		Log	
	Upper Confidence Limit	1.9 <sup>2</sup>		0.5 <sup>2</sup>	<b>117.<sup>2</sup></b>	<b>10.3</b>	0.3		<b>327.8</b>	- cis-DCE and VC are in compliance
	W Statistic	NA		NA	NA	NA	NA		0.927	
EC-2	No. of Samples	6	6	6	4	8	8	8	9	- each constituent has lower concentration after construction
	No. of Detections	6	6	6	4	2	3	2	5	- TCE, cis-DCE, VC and Cr in compliance
	Mean	<b>5.78</b>	26.5	1.1	5.84	0.93	2.27	0.10	4.08	
	Standard Deviation	2.36	7.84	1.93	2.62	1.10	2.89	0.	1.95	
	Maximum	<b>9.5</b>	37.9	<b>5.0</b>	8.0	1.7	5.6	0.1	7.3	
	Distribution Type	Log <sup>1</sup>	Log	Log	Log	Log <sup>1</sup>	NA	NA	Log	
	Upper Confidence Limit	<b>9.43</b>	35.0	<b>17.1</b>	21.0	1.7	5.6	0.1	8.6	
	W Statistic	0.956	0.807	0.794	0.859	NA	NA	NA	NA	

Notes:

1. All concentrations in µg/L
2. Bold values indicate performance standard exceeded
3. Log – Lognormal, Norm - Normal
4. <sup>1</sup> Indicates distribution type was assumed
5. <sup>2</sup> UCL assumed equivalent to maximum concentration
6. NA – Not Applicable

Table 6 Statistical summary of TCE in upper Aquifer 2.

Station		Pre-Construction 1994-1996	Post Construction 1996-1999	Last Eight Quarters 1998-1999	Comment
C2a	No. of Samples	3	13	8	<ul style="list-style-type: none"> <li>- within conditional point of compliance</li> <li>- apparent decline except for one high value</li> <li>- Post-construction <math>S_{TCE} = -42</math></li> <li>- Declining mean</li> <li>- not in compliance</li> </ul>
	No. of Detections	3	13	8	
	Mean	39.7	29.6	27.4	
	Standard Deviation	2.52	4.0	2.1	
	Maximum	42	38	31	
	Distribution Type	Lognormal	Lognormal	Lognormal	
	Upper Confidence Limit	44.6	31.7	28.8	
	W Statistic	0.979	0.924	0.873	
D2a	No. of Samples	3	13	8	<ul style="list-style-type: none"> <li>- All concentrations below MCL</li> <li>- Post-construction <math>S_{TCE} = -22</math></li> <li>- TCE in compliance</li> </ul>
	No. of Detections	3	13	8	
	Mean	2.1	2.99	2.82	
	Standard Deviation	0.46	0.93	0.62	
	Maximum	2.6	4.4	3.6	
	Distribution Type	Assumed Lognormal	Lognormal	Normal	
	Upper Confidence Limit	3.5	3.6	3.24	
	W Statistic	0.75	0.896	NA	
E2a	No. of Samples	10	13	8	<ul style="list-style-type: none"> <li>- within conditional point of compliance</li> <li>- all values above MCL</li> <li>- concentrations lower after construction</li> <li>- Post-construction <math>S_{TCE} = 2</math></li> <li>- No significant decline after construction</li> </ul>
	No. of Detections	10	13	8	
	Mean	63.2	50.1	49.3	
	Standard Deviation	6.2	4.54	4.53	
	Maximum	75	58	58	
	Distribution Type	Lognormal	Lognormal	Lognormal	
	Upper Confidence Limit	66.9	52.5	52.5	
	W Statistic	0.877	0.984	0.935	
F2a	No. of Samples	3	13	8	<ul style="list-style-type: none"> <li>- within conditional point of compliance</li> <li>- all values below MCL</li> <li>- Post-construction <math>S_{TCE} = +7</math></li> <li>- No trend</li> <li>- TCE in compliance</li> </ul>
	No. of Detections	3	13	8	
	Mean	1.97	1.98	2.05	
	Standard Deviation	1.24	1.1	1.29	
	Maximum	3.4	3.9	3.9	
	Distribution Type	Assumed Lognormal	Lognormal	Lognormal	
	Upper Confidence Limit	4.1	2.92	4.0	
	W Statistic	NA	0.919	0.889	

Table 6 continued

Station		Pre-Construction 1994-1996	Post Construction 1996-1999	Last Eight Quarters 1998-1999	Comment
G2a	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	3 3 10.6 1.25 12. Lognormal 13.3 0.853	12 12 7.4 3.51 17 Lognormal 9.5 0.939	8 8 6.2 1.74 9. Lognormal 7.8 0.937	- within conditional point of compliance - Apparent declining trend - Post-construction $S_{TCE} = -21$ - Not in compliance
H2a	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	No Data	13 13 1.9 0.62 2.9 Lognormal 2.35 0.920	8 8 1.99 0.56 2.9 Normal 2.36 NA	- All TCE below MCL - In compliance
I2a	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	10 10 4.29 0.67 4.9 Assumed Lognormal 4.81 NA	13 13 2.23 0.644 3.5 Lognormal 2.6 0.961	8 8 1.92 0.41 2.4 Lognormal 2.3 0.856	- within conditional point of compliance - Declining trend since construction - All TCE below MCL - In compliance
J2a	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	10 0 ND	9 0 ND	8 0 ND	- all TCE data below detection limit - in compliance



Table 6 continued

Station		Pre-Construction 1994-1996	Post Construction 1996-1999	Last Eight Quarters 1998-1999	Comment
K2a	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	3 0 ND	5 0 ND	2 0 ND	- all TCE data below detection limit - in compliance
L2a	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	10 10 7.5 3.63 14. Lognormal 10.8 0.878	13 13 6.0 2.96 12. Lognormal 8.2 0.977	8 8 5.8 3.43 12. Lognormal 10.3 0.967	- seasonal fluctuation - mean declined after construction - post-construction $S_{TCE} = -22$ indicating declining trend - not in compliance
M2a	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	No Data	13 4 1.4 1.16 3.1 Lognormal 3.1 NA	8 3 1.57 1.36 3.1 Lognormal 3.1 NA	- all TCE data below detection limit - in compliance
N2a	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	3 3 0.49 0.103 0.6 Lognormal 0.8 0.969	13 5 0.5 0.23 0.7 Lognormal 0.7 NA	8 1 0.6 NA 0.6 NA 0.6 NA	- all TCE data below MCL - in compliance

Table 6 continued

Station		Pre-Construction 1994-1996	Post Construction 1996-1999	Last Eight Quarters 1998-1999	Comment
O2a	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	3 0 ND	9 0 ND	6 0 ND	- all TCE data below detection limit - in compliance
R2a	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	3 3 1.19 0.525 1.8 Lognormal 5.63 0.774	13 8 1.39 0.55 2.3 Normal 1.25 NA	8 4 1.5 0.27 1.9 Assumed Lognormal 3.7 NA	- all TCE data below MCL - seasonal fluctuation with minimum during winter - in compliance
S2a	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	3 3 7.8 0.436 8.1 Assumed Lognormal 8.6 NA	13 13 4.58 1.04 6.6 Lognormal 5.2 0.884	8 8 3.88 0.377 4.6 Lognormal 4.14 0.852	- apparent declining trend - post-construction $S_{TCE} = -62$ indicating declining trend - in compliance
V2a	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	3 3 14.0 1.73 16. Assumed Lognormal 17.88 0.7515	12 12 8.81 3.24 15 Normal 10.5 NA	8 8 8.74 1.80 11. Lognormal 10.43 0.885	- post-construction $S_{TCE} = +3$ indicating no significant trend - less variation in recent data

## Notes:

1. All concentrations in  $\mu\text{g/L}$ .
2. ND – not detected above the method detection limit.

Table 7 Statistical summary of TCE in lower Aquifer 2.

Station		Pre-Construction 1994-1996	Post Construction 1996-1999	Last Eight Quarters 1998-1999	Comment
A2	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	10 0 ND	9 0 ND	6 0 ND	- all TCE data was less than detection limit
B2	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	10 10 55.3 3.39 61. Lognormal 57.3 0.934	13 13 45. 5.07 56. Lognormal 47.61 0.929	8 8 41.6 2.07 45 Lognormal 43.1 0.944	- within conditional point of compliance - apparent declining trend - Post-construction $S_{TCE} = -55$ - Not in compliance
C2	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	10 10 40.7 2.17 46. Assumed Lognormal 42.0 0.806	13 13 46.2 4.30 54. Lognormal 48.4 0.977	8 8 48.3 3.73 54. Lognormal 50.9 0.925	- within conditional point of compliance - apparent increasing trend since construction - post-construction $S_{TCE} = 50$ indicating increasing trend - not in compliance
D2	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	10 0 ND	14 0 ND	7 0 ND	- TCE not detected
E2	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	10 10 92.8 5.50 100. Lognormal 96.2 0.946	13 13 86 4 93 Lognormal 88.9 0.880	8 8 84. 4.57 93. Assumed lognormal 87.1 0.807	- within conditional point of compliance - all TCE above MCL - no significant trend, $S_{TCE} = -12$

Table 7 Statistical summary of TCE in lower Aquifer 2.

Station		Pre-Construction 1994-1996	Post Construction 1996-1999	Last Eight Quarters 1998-1999	Comment
A2	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	10 0 ND	9 0 ND	6 0 ND	- all TCE data was less than detection limit
B2	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	10 10 55.3 3.39 61. Lognormal 57.3 0.934	13 13 45. 5.07 56. Lognormal 47.61 0.929	8 8 41.6 2.07 45 Lognormal 43.1 0.944	- within conditional point of compliance - apparent declining trend - Post-construction $S_{TCE} = -55$ - Not in compliance
C2	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	10 10 40.7 2.17 46. Assumed Lognormal 42.0 0.806	13 13 46.2 4.30 54. Lognormal 48.4 0.977	8 8 48.3 3.73 54. Lognormal 50.9 0.925	- within conditional point of compliance - apparent increasing trend since construction - post-construction $S_{TCE} = 50$ indicating increasing trend - not in compliance
D2	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	10 0 ND	14 0 ND	7 0 ND	- TCE not detected
E2	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	10 10 92.8 5.50 100. Lognormal 96.2 0.946	13 13 86 4 93 Lognormal 88.9 0.880	8 8 84. 4.57 93. Assumed lognormal 87.1 0.807	- within conditional point of compliance - all TCE above MCL - no significant trend, $S_{TCE} = -12$

Table 7 continued

Station		Pre-Construction 1994-1996	Post Construction 1996-1999	Last Eight Quarters 1998-1999	Comment
F2	No. of Samples	10	13	8	- within conditional point of compliance
	No. of Detections	10	13	8	- mean and UCL values are declining
	Mean	76.1	63.3	59.9	- Post-construction $S_{TCE} = -32$ indicates declining trend
	Standard Deviation	7.21	5.78	4.36	- Not in compliance
	Maximum	91.	72.	66.	
	Distribution Type	Lognormal	Lognormal	Lognormal	
	Upper Confidence Limit	80.5	66.4	63.1	
G2	W Statistic	0.974	0.951	0.899	
	No. of Samples	10	13	8	- within conditional point of compliance
	No. of Detections	10	13	8	- no apparent or significant trend
	Mean	39.4	40.8	40.6	- post-construction $S_{TCE} = 4$
	Standard Deviation	3.10	2.31	2.6	
	Maximum	44.	46.	46.	
	Distribution Type	Lognormal	Lognormal	Lognormal	
H2	Upper Confidence Limit	41.3	41.9	42.4	
	W Statistic	0.891	0.930	0.901	
	No. of Samples	6	13	8	- no TCE detected
	No. of Detections	0	0	0	
	Mean	ND	ND	ND	
	Standard Deviation				
	Maximum				
I2	Distribution Type				
	Upper Confidence Limit				
	W Statistic				
	No. of Samples	11	13	8	- within conditional point of compliance
	No. of Detections	11	13	8	- Apparent declining trend
	Mean	63.6	47.2	43.0	- Post-construction $S_{TCE} = -47$
	Standard Deviation	7.8	6.5	2.93	- Not in compliance
J2	Maximum	77.	59.	46.	
	Distribution Type	Lognormal	Lognormal	Lognormal	
	Upper Confidence Limit	68.3	50.7	45.2	
	W Statistic	0.987	0.947	0.826	
	No. of Samples	10	9	6	- no TCE detected
	No. of Detections	0	0	0	
	Mean	ND	ND	ND	
	Standard Deviation				
	Maximum				
	Distribution Type				
	Upper Confidence Limit				
	W Statistic				

Table 7 continued

Station		Pre-Construction 1994-1996	Post Construction 1996-1999	Last Eight Quarters 1998-1999	Comment
K2	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	10 0 ND	9 0 ND	6 0 ND	- No TCE detected
L2	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	11 11 30.79 3.54 37 Normal 32.7	13 13 26.2 1.69 29. Lognormal 27.1 0.906	8 8 25.5 1.41 27. Assumed Lognormal 26.5 0.797	- Apparent declining trend - Post-construction $S_{TCE} = -47$ indicating decreasing trend - Not in compliance
M2	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	11 11 13.2 1.35 15. Lognormal 14.0 0.902	13 13 6.1 3.97 13. Normal 8.1	8 8 4.1 2.98 8.8 Normal 6.1 0.903	- declining mean and UCL values - apparent declining trend - post-construction $S_{TCE} = -40$ not yet in compliance
N2	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	11 0 ND	13 0 ND	8 0 ND	- No TCE detected
O2	No. of Samples No. of Detections Mean Standard Deviation Maximum Distribution Type Upper Confidence Limit W Statistic	10 0 ND	12 0 ND	7 0 ND	- No TCE detected

Table 7 continued

Station		Pre-Construction 1994-1996	Post Construction 1996-1999	Last Eight Quarters 1998-1999	Comment
R2	No. of Samples	3	12	8	- TCE not detected after November 1996
	No. of Detections	3	1	0	
	Mean	0.31	0.2	ND	
	Standard Deviation	0.012	NA		
	Maximum	0.32	0.2		
	Distribution Type	Assumed Lognormal	NA		
	Upper Confidence Limit	0.33	0.2		
	W Statistic	0.756	NA		
S2	No. of Samples	3	13	8	- Only one sample had detectable concentration of TCE (October 1999)
	No. of Detections	0	0	1	
	Mean	ND	ND	0.4	
	Standard Deviation			NA	
	Maximum			0.4	
	Distribution Type			NA	
	Upper Confidence Limit			0.4	
	W Statistic			NA	
T2	No. of Samples	3	7	4	- no TCE detected
	No. of Detections	0	0	0	
	Mean	ND	ND	ND	
	Standard Deviation				
	Maximum				
	Distribution Type				
	Upper Confidence Limit				
	W Statistic				
U2	No. of Samples	2	13	8	- no TCE detected
	No. of Detections	0	0	0	
	Mean	ND	ND	ND	
	Standard Deviation				
	Maximum				
	Distribution Type				
	Upper Confidence Limit				
	W Statistic				
MW-71	No. of Samples	3	12	8	- no TCE detected
	No. of Detections	0	0	0	
	Mean	ND	ND	ND	
	Standard Deviation				
	Maximum				
	Distribution Type				
	Upper Confidence Limit				
	W Statistic				

## Notes:

1. All concentrations in µg/L. 2. ND – not detected above the method detection limit.

Table 8 Trend analysis of mean TCE concentration in lower aquifer 2

Location	1988-89	1990-91	1994	1995	1996	1997	1998	1999	Mann-Kendall "S" value	Probability	Direction of Trend
A2	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--
B2 *	77.5	66.0	54.9	56.0	54.0	50.5	33.8	40.5	-24	0.00087	Downward
C2 *	38.6	32.0	41.5	41.0	39.8	43.8	35.3	50.0	10	0.138	Upward
D2	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--
E2 *	135.0	114.0	87.8	94.0	95.0	95.0	63.8	86.3	-15	0.0425	Downward
F2 *	106.0	91.0	77.2	79.0	69.5	69.5	58.3	61.5	-23	0.00184	Downward
G2 *	31.0	39.0	40.5	37.0	40.5	41.8	31.5	40.8	11	0.114	Upward
H2	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--
I2 *		75.0	63.0	67.0	59.8	52.8	42.0	44.0	-17	0.0054	Downward
J2		ND	ND	ND	ND	ND	ND	ND	--	--	--
K2		ND	ND	ND	ND	ND	ND	ND	--	--	--
L2		40.0	33.4	29.0	29.3	27.5	25.5	25.5	-18	0.0034	Downward
M2		16.0	13.2	14.0	11.8	10.1	6.6	3.1	-19	0.0014	Downward
N2		ND	0.2	ND	0.1	ND	ND	ND	--	--	--
O2		ND	ND	ND	ND	ND	ND	ND	--	--	--
P2		ND	ND	ND	ND	ND	ND	ND	--	--	--
R2					0.3	ND	ND	ND	--	--	--
S2					ND	ND	ND	0.3	--	--	--
T2					ND	ND	ND	ND	--	--	--
U2					ND	ND	ND	ND	--	--	--
MW-71						ND	ND	ND	--	--	--

**Notes**

1. All concentrations in micrograms per liter (ug/L)
2. ND indicates "Not Detected" above the method detection limit which varied between 0.1 and 0.5 ug/L
3. -- indicates calculation not performed
4. Source of data - Landau (1990), EcoChem (1994-1998), EcoChem (1999 a,b,c,d)
5. Direction of trend tested at 95% confidence level.
6. \* indicates well is within conditional point of compliance



Table 9 Trend analysis of mean TCE concentration in upper aquifer 2

Location	1988-89	1990-91	1994	1995	1996	1997	1998	1999	Mann-Kendall "S" value	Probability	Direction of Trend
C2a *					38.5	32.8	28.5	26.3	-6	0.042	Downward
D2a					2.7	3.0	3.0	2.6	-1	0.5	No Trend
E2a *		72.0	63.3	64.7	57.5	53.0	47.0	51.5	-17	0.0054	Downward
F2a *					2.2	1.6	2.2	1.9	-1	0.5	No Trend
G2a *					12.2	7.6	6.3	6.1	-6	0.042	Downward
H2a					2.8	1.5	1.9	2.1	0	0.625	No Trend
I2a *		7.0	4.7	4.4	3.6	2.6	1.6	2.3	-19	0.0014	Downward
J2a			ND	ND	ND	ND	NS	ND	--	--	--
K2a					ND	ND	NS	ND	--	--	--
L2a		10.0	6.1	7.0	8.3	6.9	5.2	6.3	-9	0.119	No Trend
M2a					0.5	0.2	0.5	1.0	2	0.375	No Trend
N2a					0.4	0.5	0.3	ND	-4	--	--
O2a				ND	ND	ND	NS		--	--	--
R2a					1.5	0.8	1.0	0.8	-3	0.271	No Trend
S2a					7.5	5.5	4.1	3.7	-6	0.042	Downward
V2a					12.0	9.9	7.9	9.6	-4	0.167	No Trend

**Notes**

1. All concentrations in micrograms per liter (ug/L)
2. ND indicates "Not Detected" above the method detection limit which varied between 0.1 and 0.5 ug/L
3. -- indicates calculation not performed
4. Source of data - Landau (1990), EcoChem (1994-1998), EcoChem (1999 a,b,c,d)
5. Direction of trend tested at 95% confidence level.
6. \* indicates well is within conditional point of compliance

Table 10 Linear regression analysis of post-construction TCE in Aquifer 2.

Location	Slope	Y Intercept	R <sup>2</sup> Coefficient	Projected Time Required for TCE to reach 5 µg/L (years)	Projected Time Required for TCE to reach 50 µg/L (years)	Projected Year Performance Standard Reached
B2 *	-0.0125	493.3	0.72	10	1	2008
C2 *	0.0098	-303.9	0.61	NA	NA	NA
E2 *	-0.0037	218.0	0.07	<b>62</b>	<b>29</b>	2059
F2 *	-0.0093	396.9	0.31	19	6	2015
G2 *	0.0006	18.54	0.01	NA	NA	NA
I2 *	-0.0144	565.0	0.59	10	1	2006
L2	-0.0024	112.5	0.24	<b>26</b>	NA	2022
M2	-0.0076	280.3	0.44	2	NA	1998
C2a *	-0.0098	382.4	0.72	9	NA	2005
E2a *	+0.001	10.2	0.01	NA	NA	NA
G2a *	-0.0062	229.9	0.33	3	NA	1999
L2a	-0.0019	74.7	0.04	3	NA	1999
S2a	-0.0028	106.0	0.86	1	NA	1997
V2a	0.00006	-14.2	0.004	NA	NA	NA

**Notes**

1. This table to be read in conjunction with accompanying report.
2. The TCE performance standard is 5 µg/L.
3. Time required to meet the standard is measured from barrier wall completion on 5 September 1996, which has a date code of 35314 days. Day 1 is 1 January 1900.
4. This analysis assumes that data fits a linear trend ( $y = mx + b$ , where  $y$  is concentration,  $m$  is slope constant and  $x$  refers to time in days). Examination of  $R^2$  coefficients indicate that linearity is very low and therefore estimates of time to reach the standard may be unreliable.
5. Wells for which a trend was not determined are not included in this analysis.
6. \* indicates well is located within conditional point of compliance
7. Values of projected time exceeding 10 years are in bold.
8. NA indicates analysis is not appropriate e.g. trend is not decreasing or concentration less than target value.

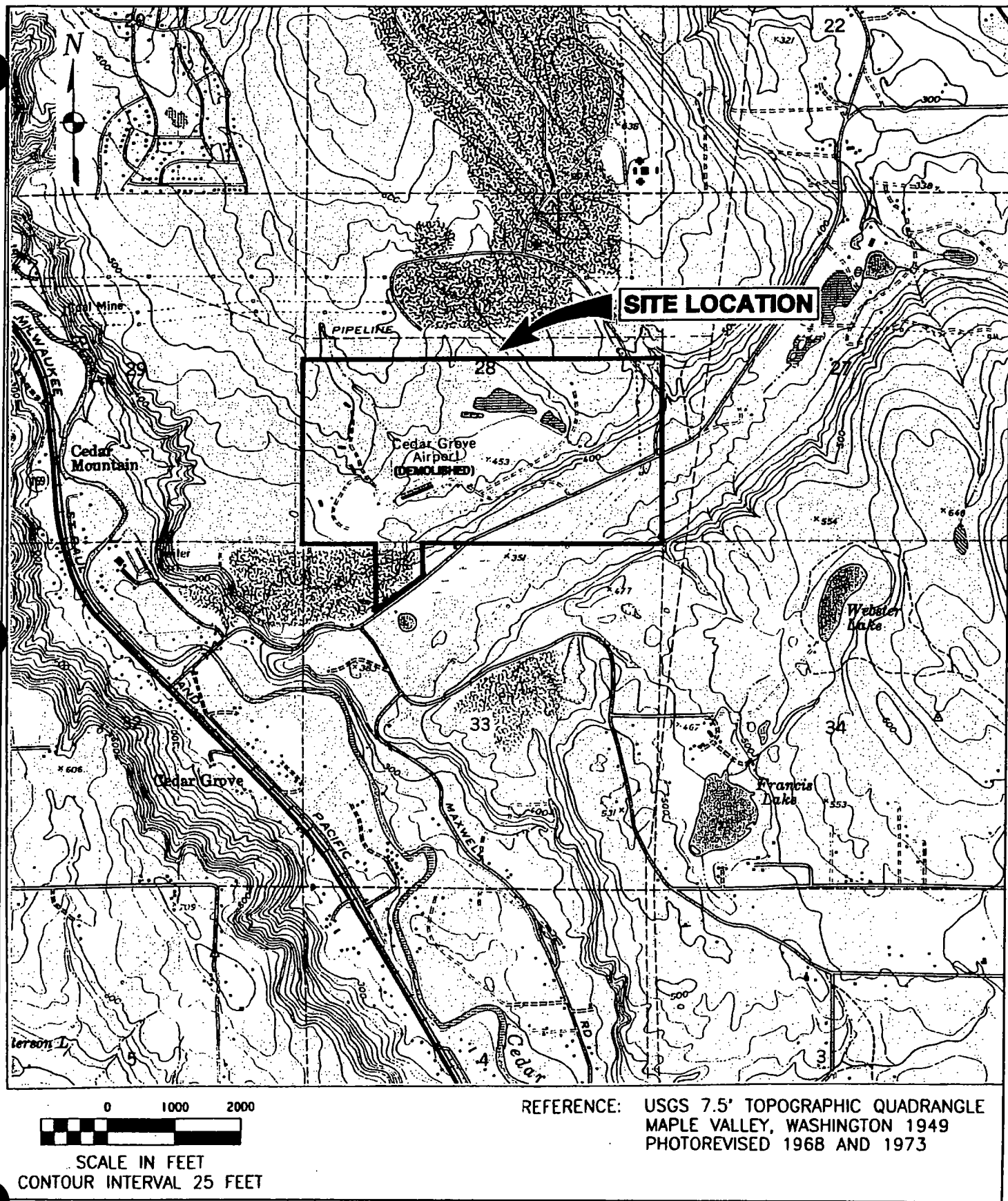


Figure 1 Location plan, Queen City Farms

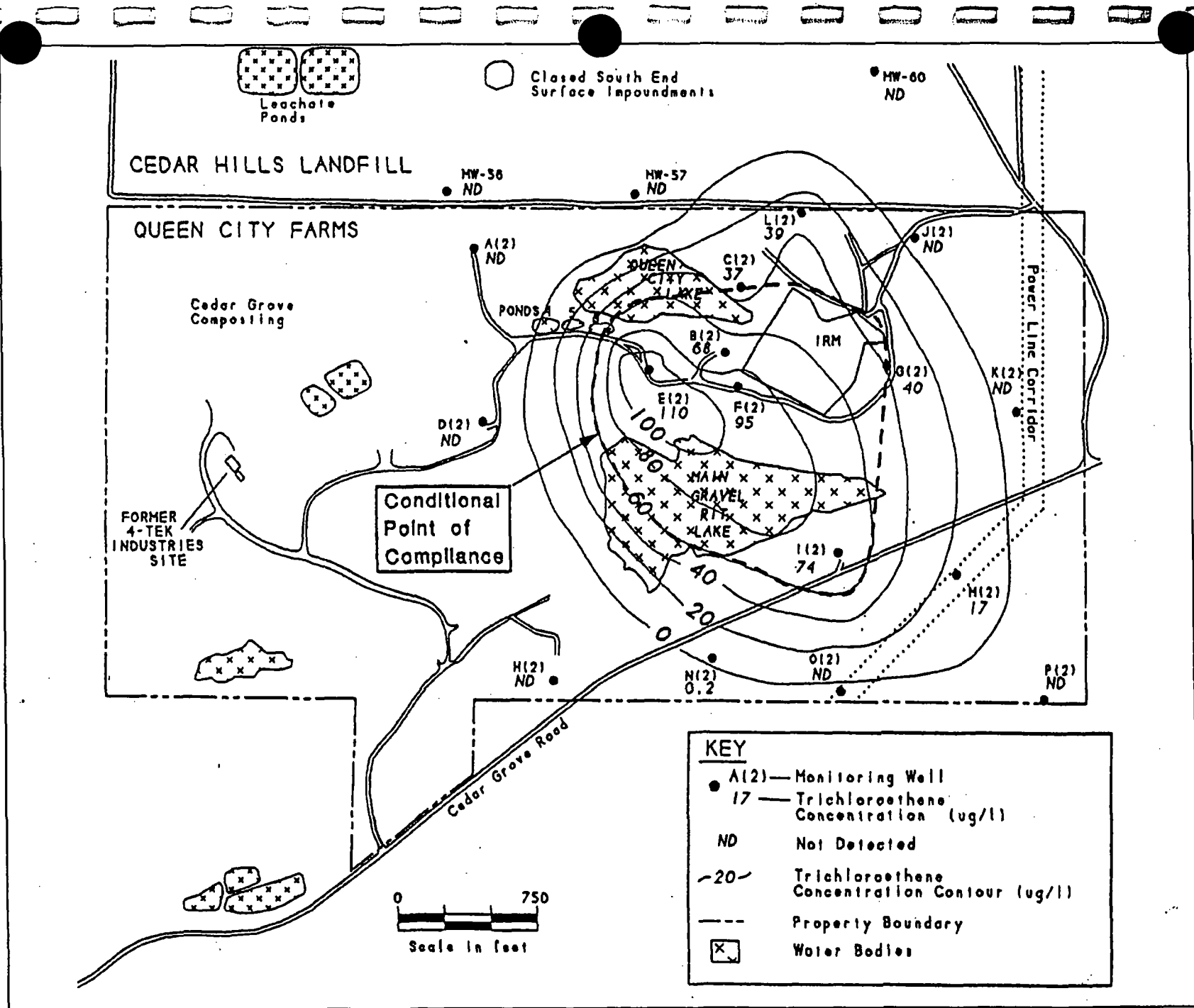


Figure 2 Conditional point of compliance (source: Consent Decree, 1993)

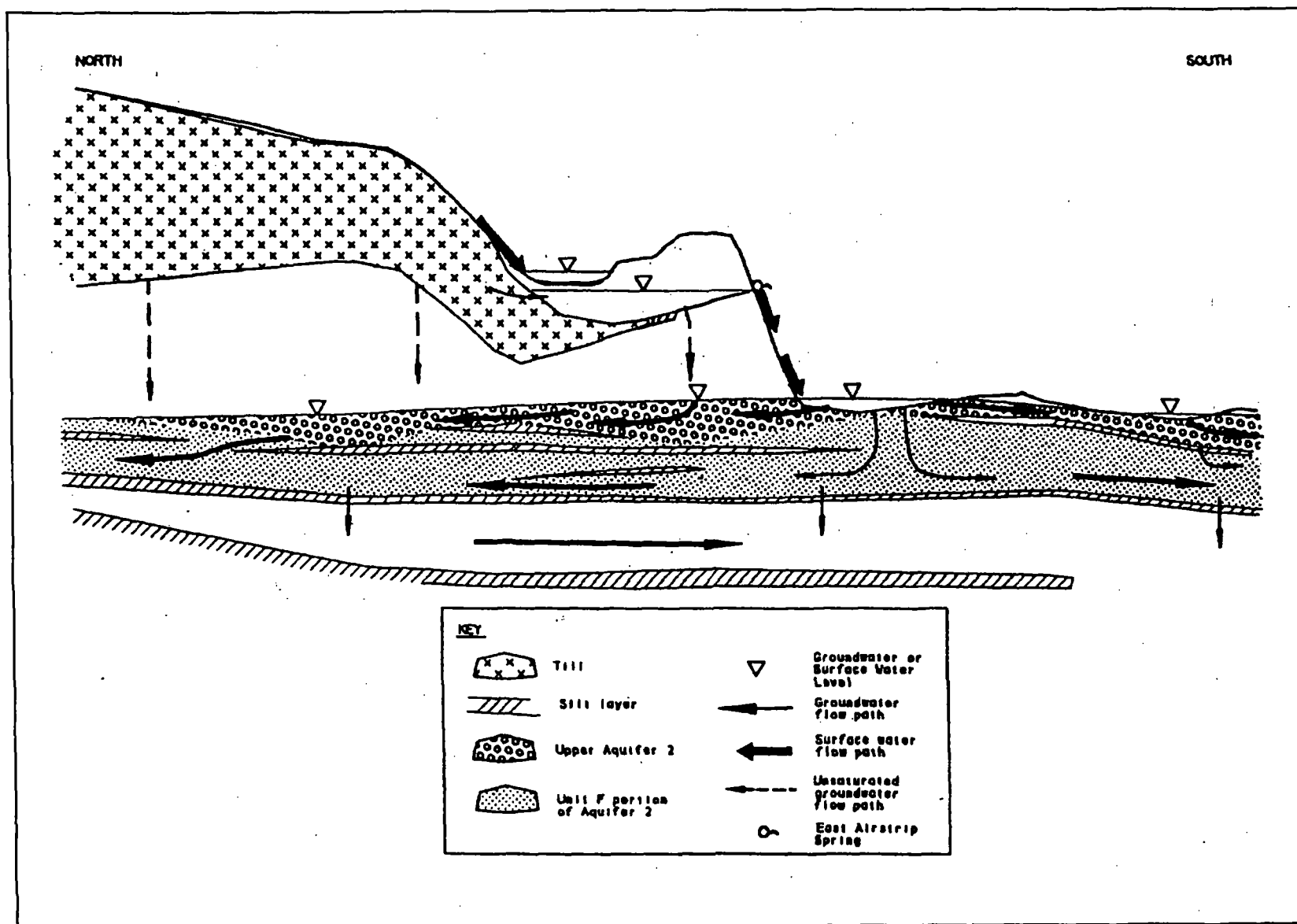


Figure 3 Conceptual hydrogeological model, Queen City Farms

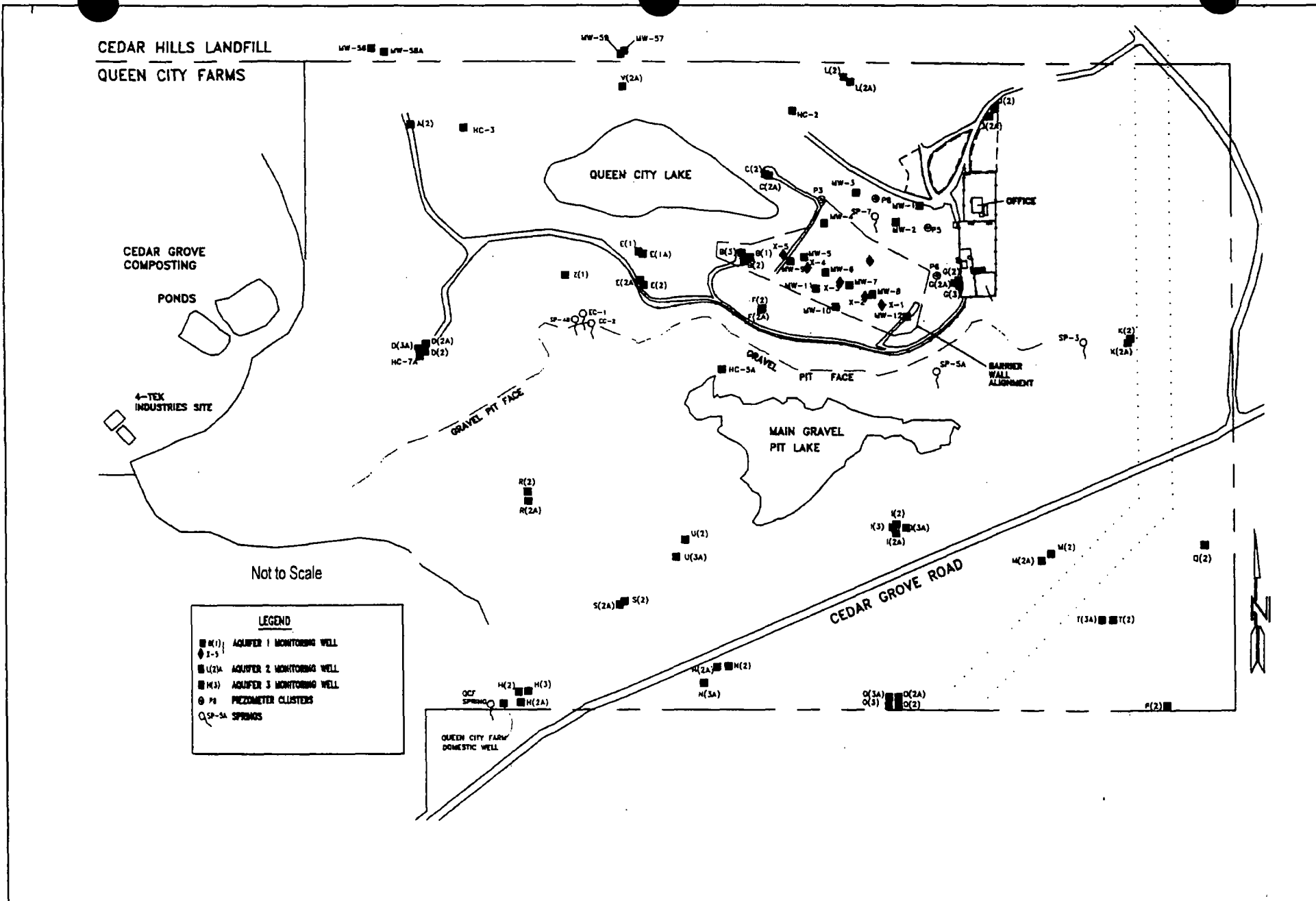


Figure 4 Monitoring locations, Queen City Farms

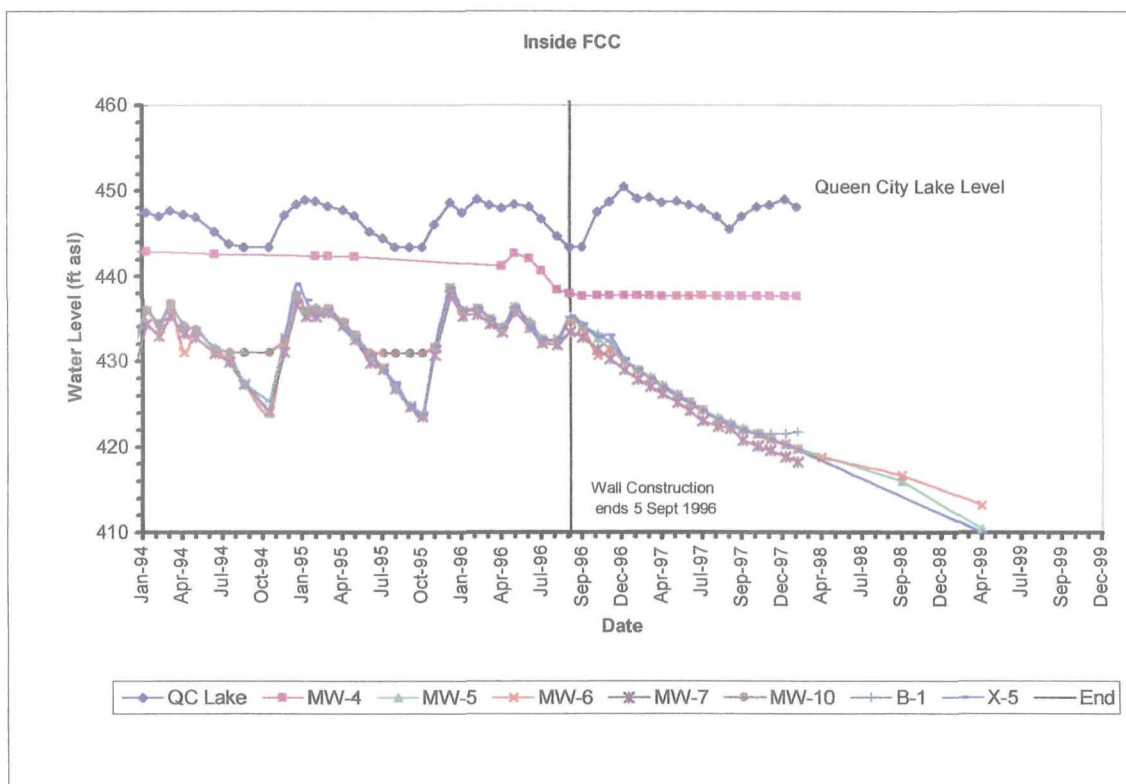
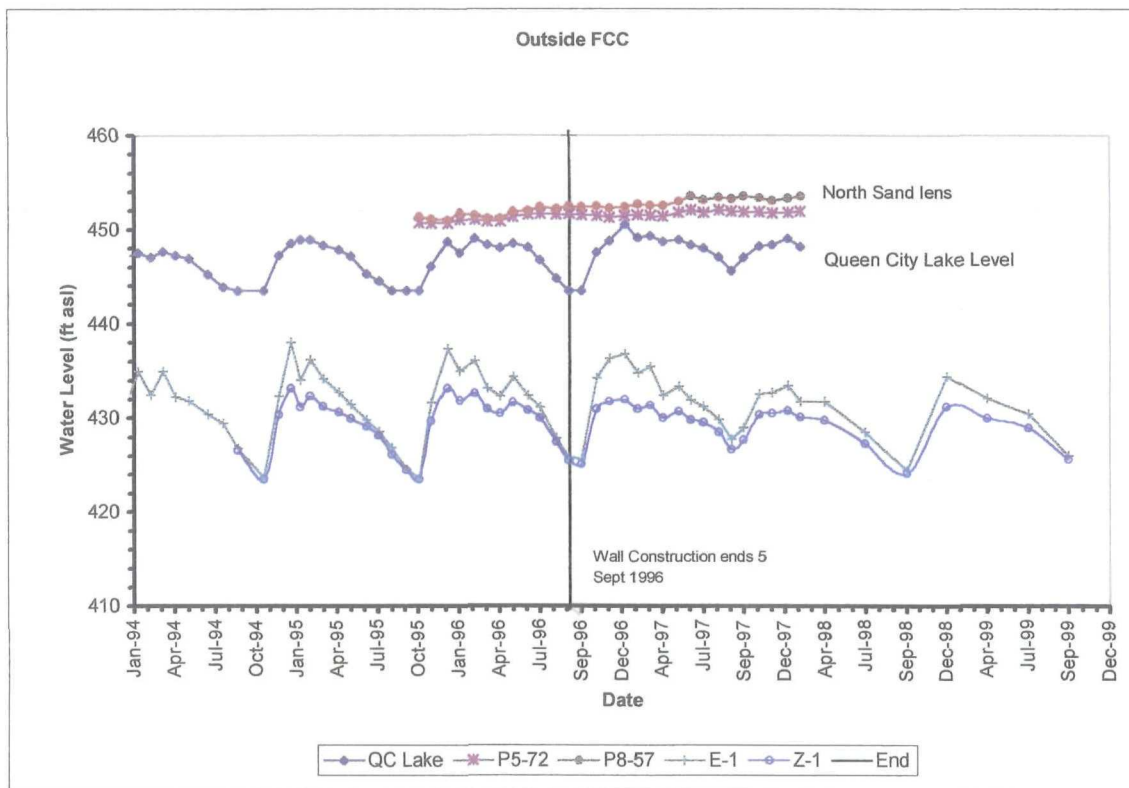


Figure 5 Groundwater levels in Aquifer 1





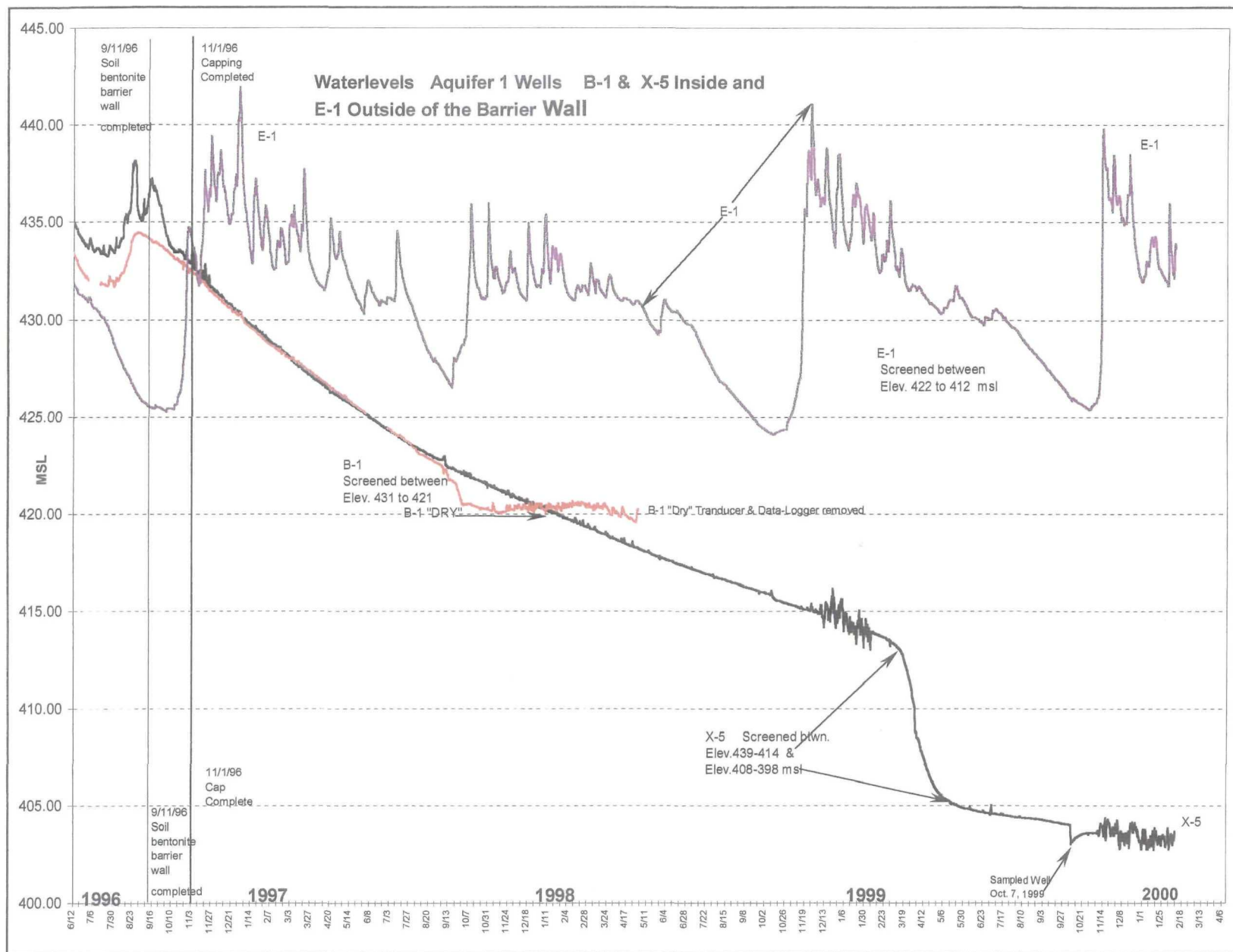


Figure 7 Detailed groundwater level comparison in Aquifer 1.

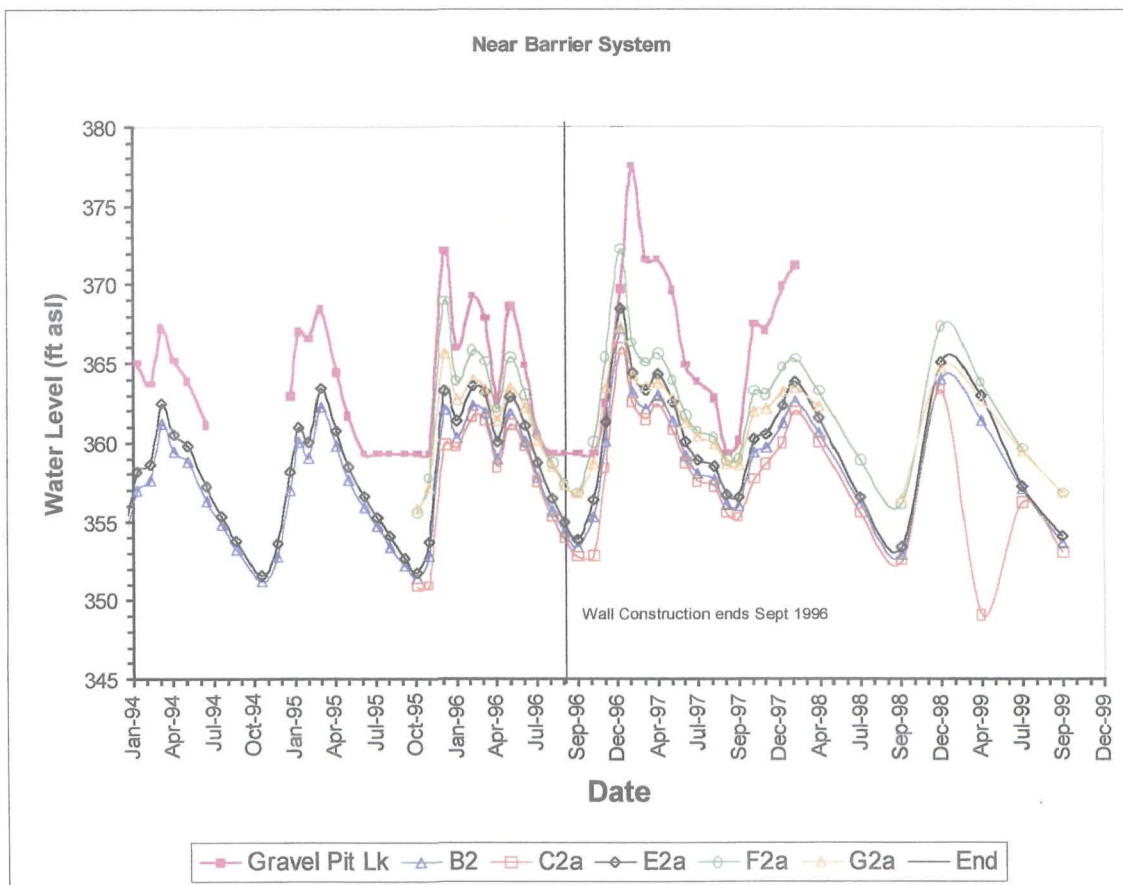
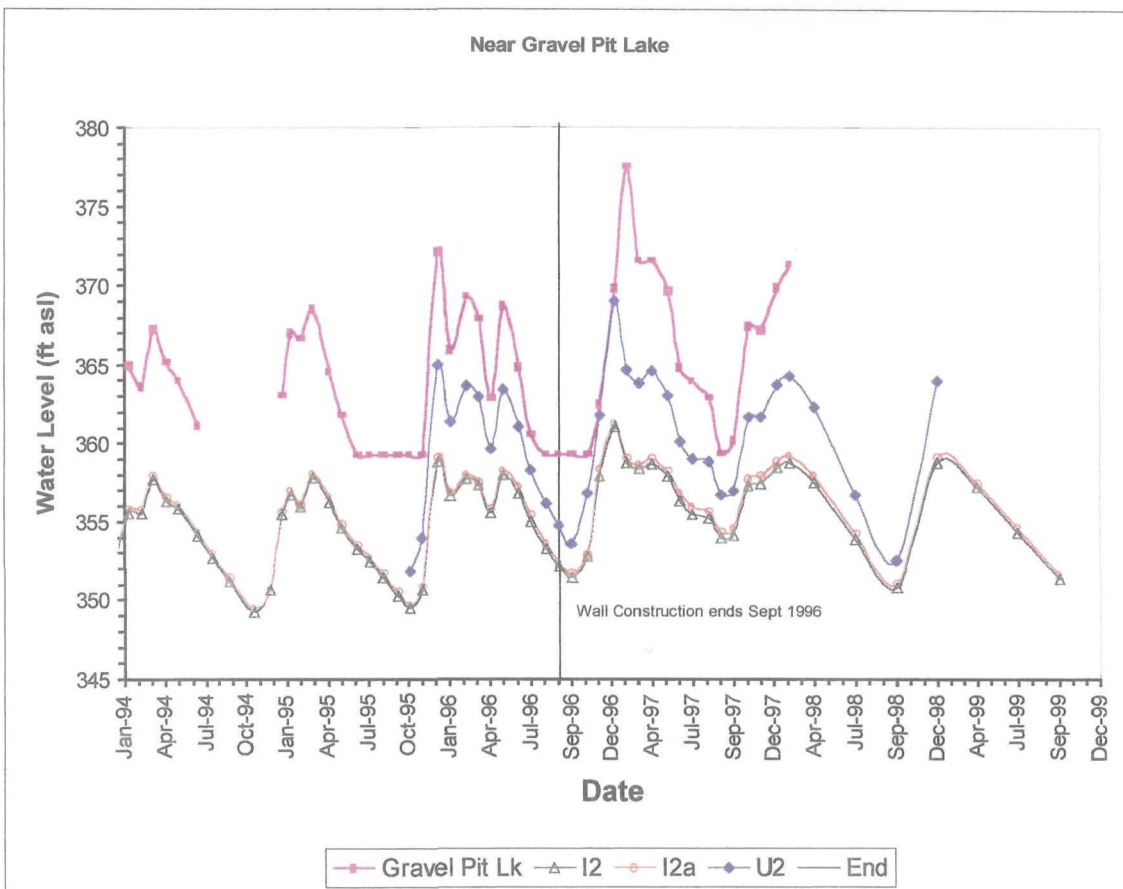


Figure 8 Groundwater levels in Aquifer 2 versus time

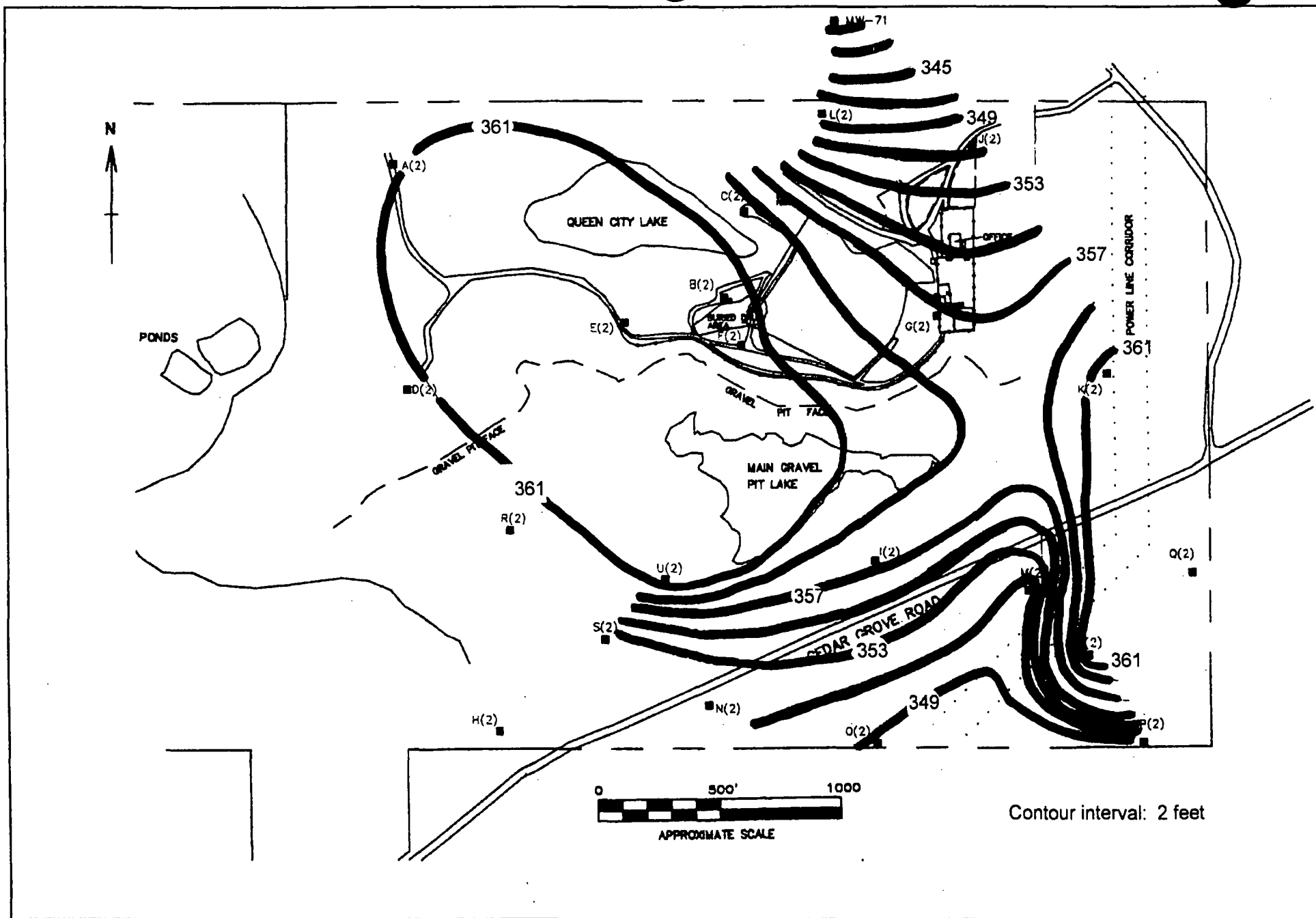


Figure 9 Aquifer 2 potentiometric map, April 1999

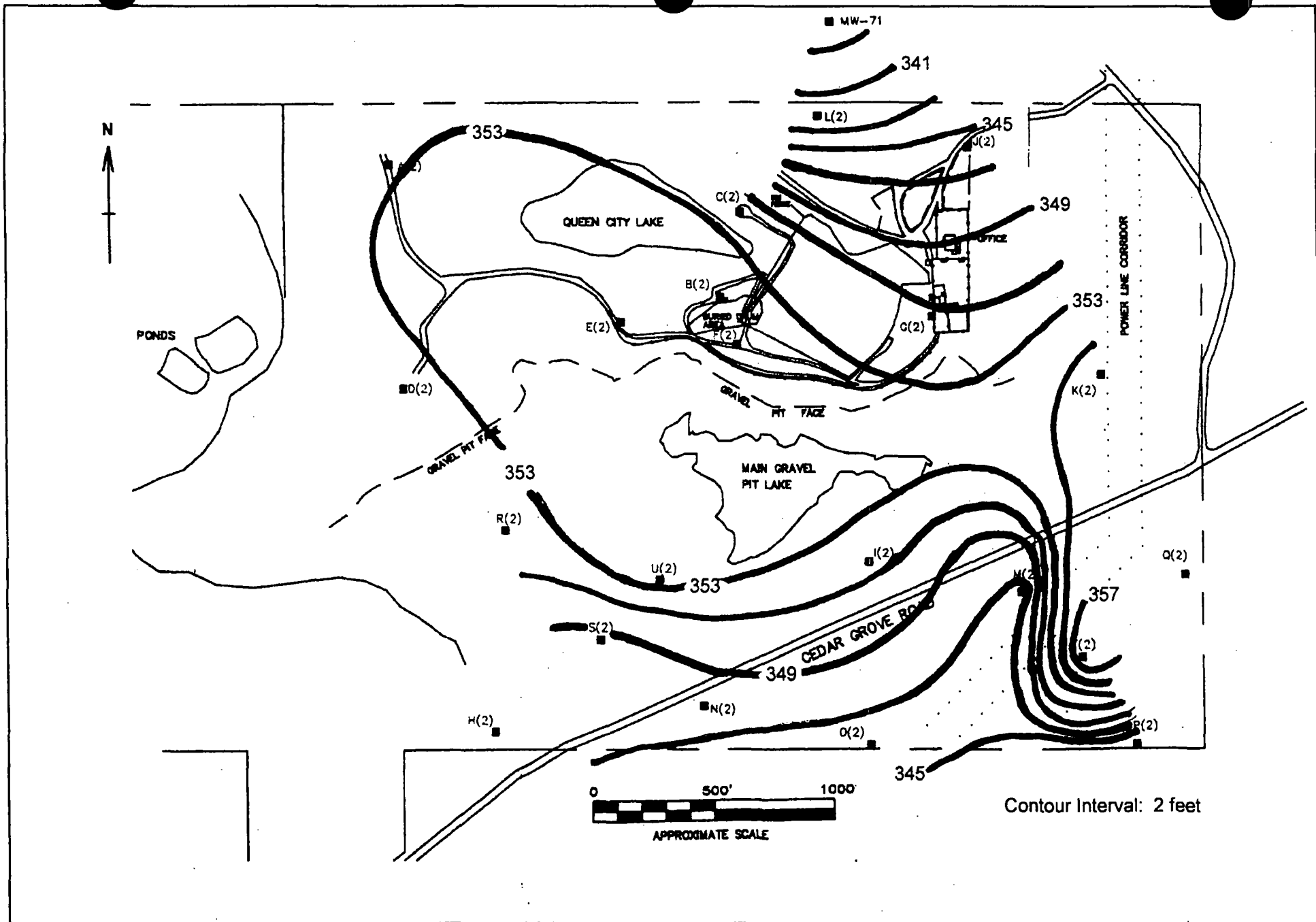


Figure 10 Aquifer 2 potentiometric map, October 1999

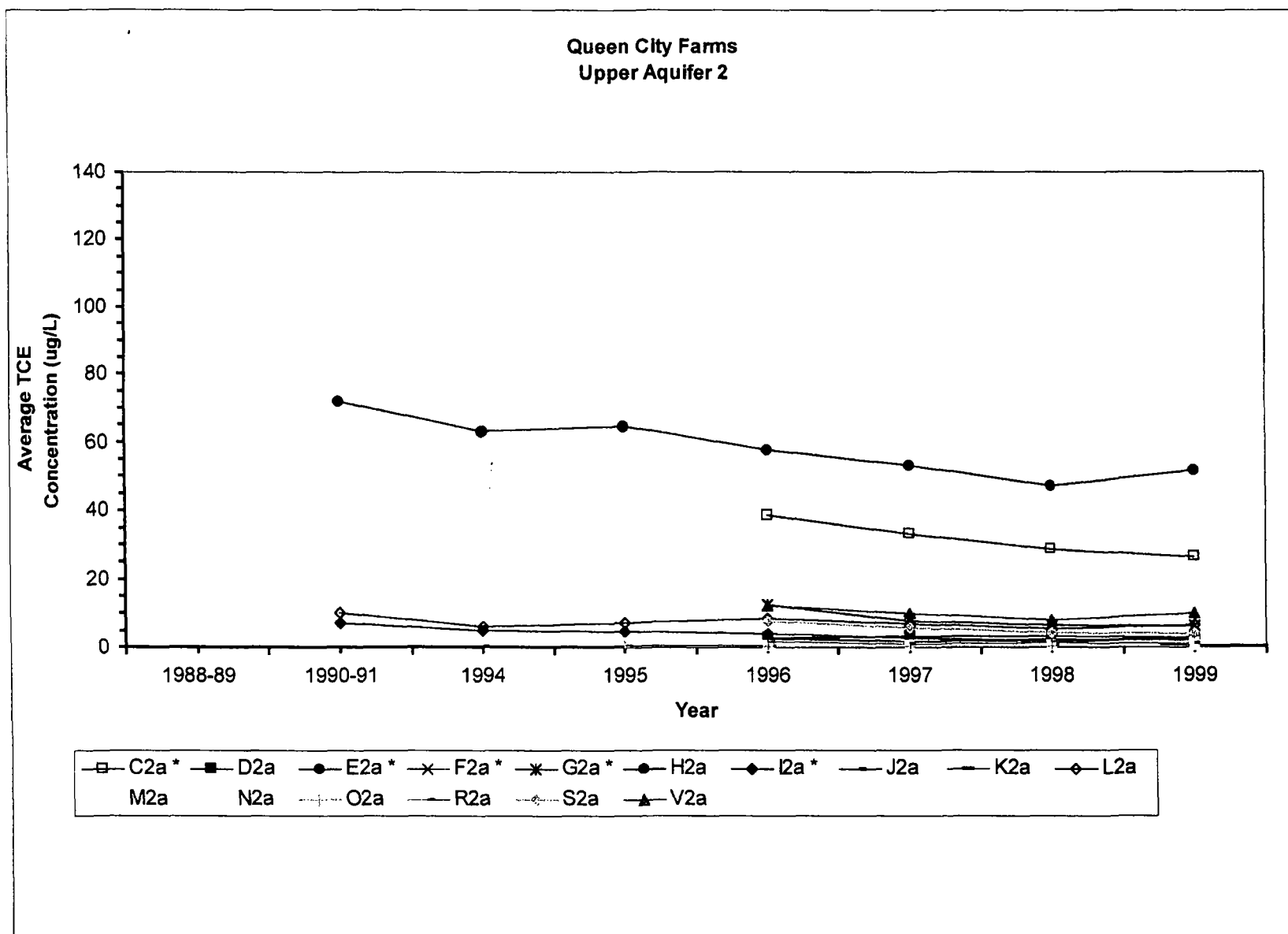


Figure 11 Average TCE concentration versus time in upper Aquifer 2.

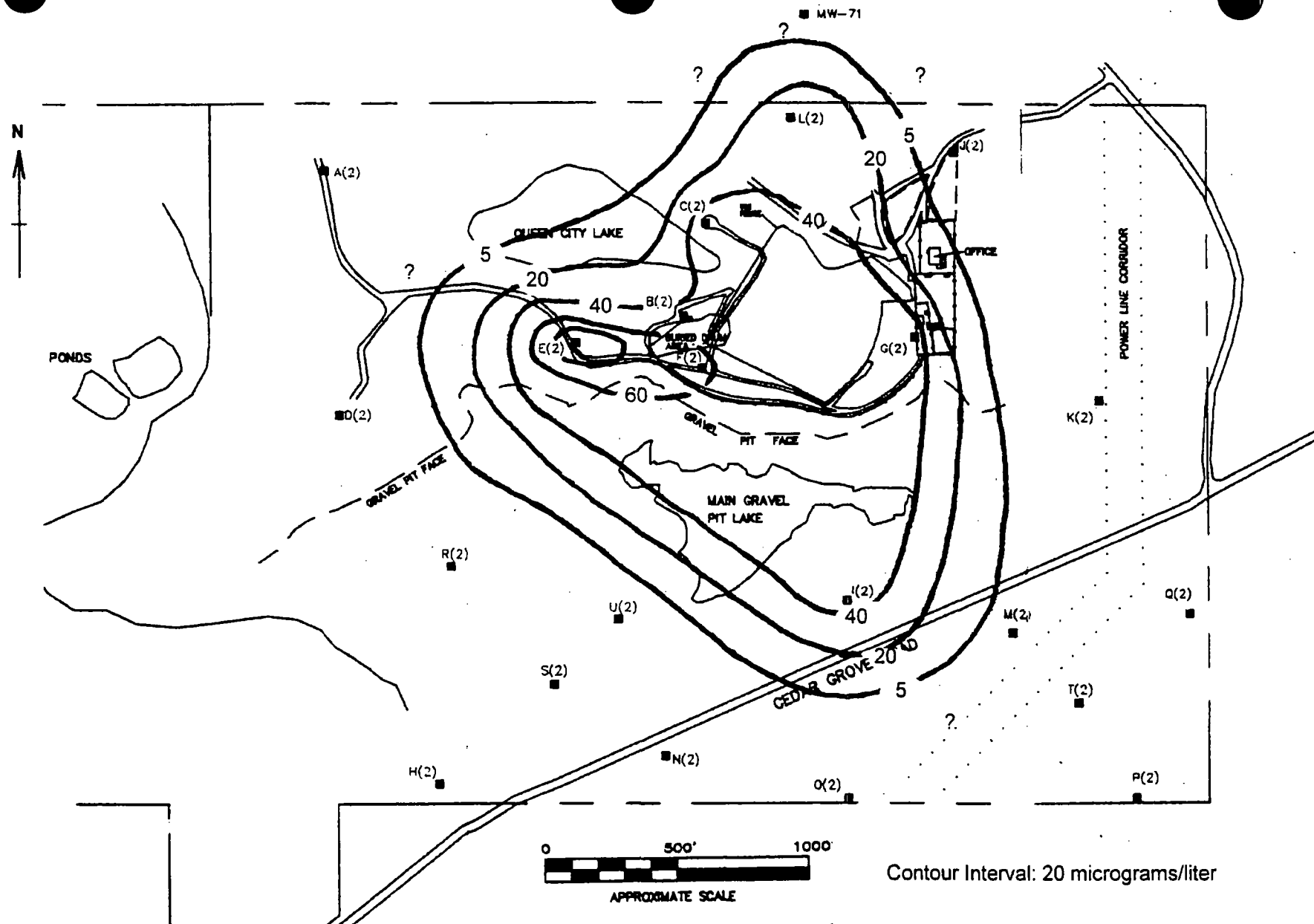


Figure 12 Inferred distribution of lower Aquifer 2 TCE plume, October 1999

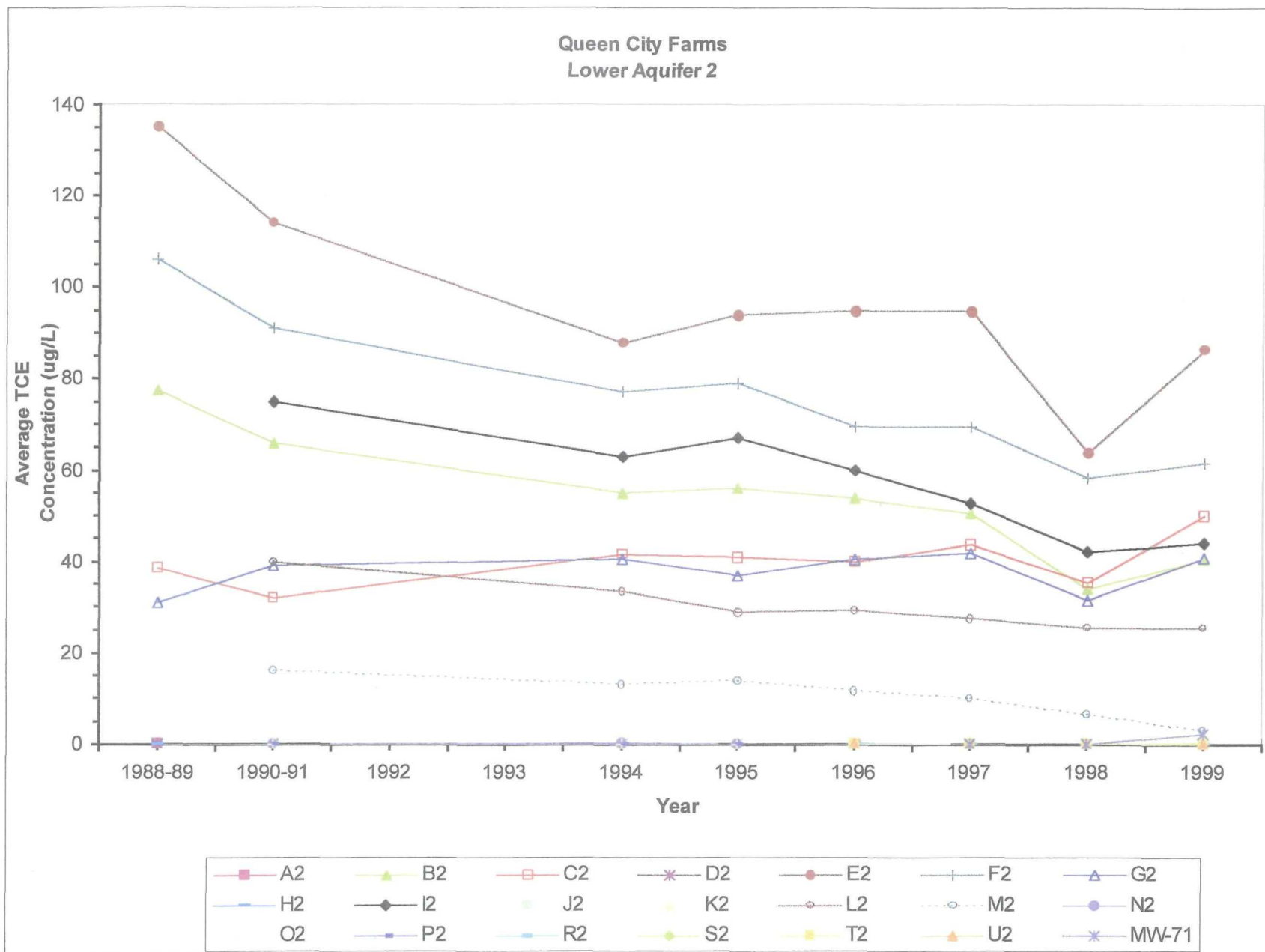


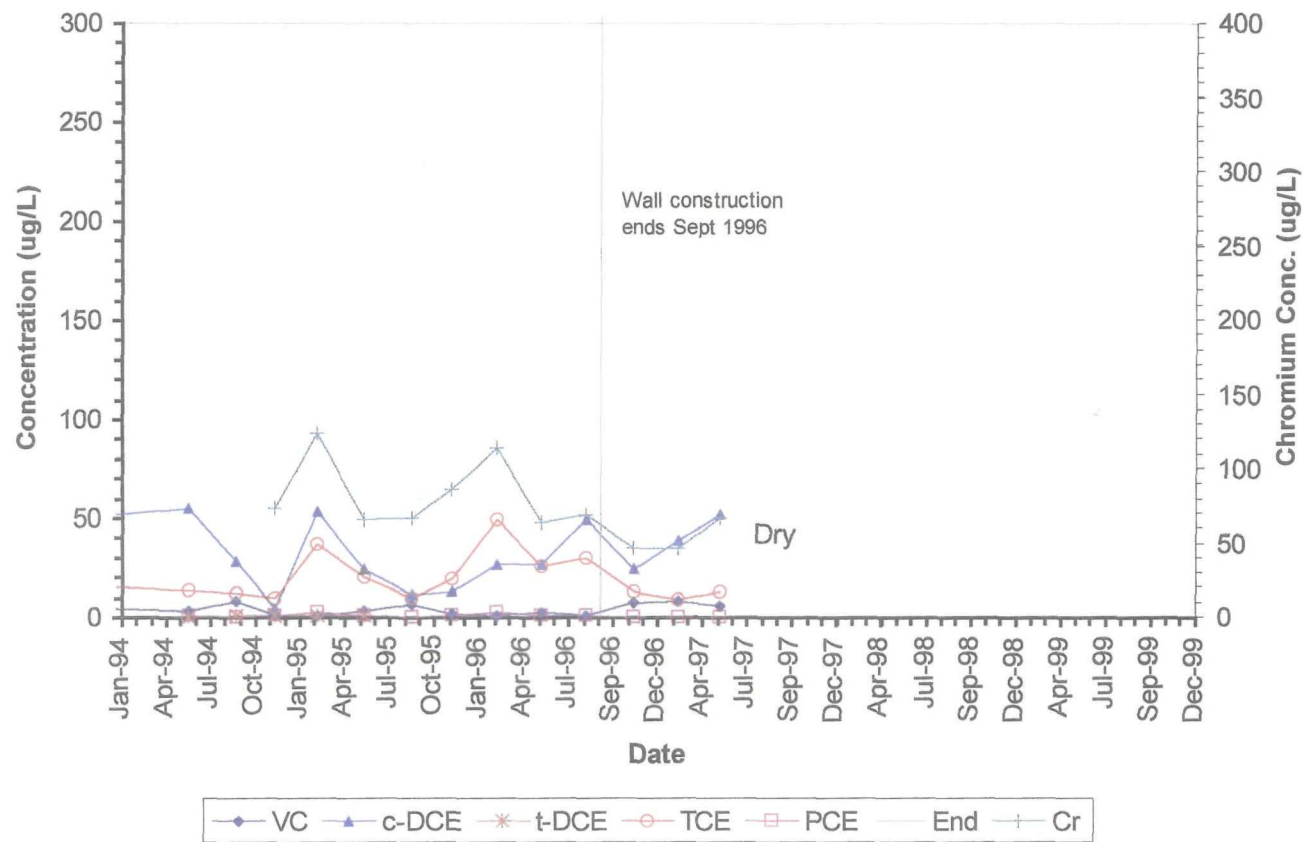
Figure 13 Average TCE concentration versus time in lower Aquifer 2.

APPENDIX A

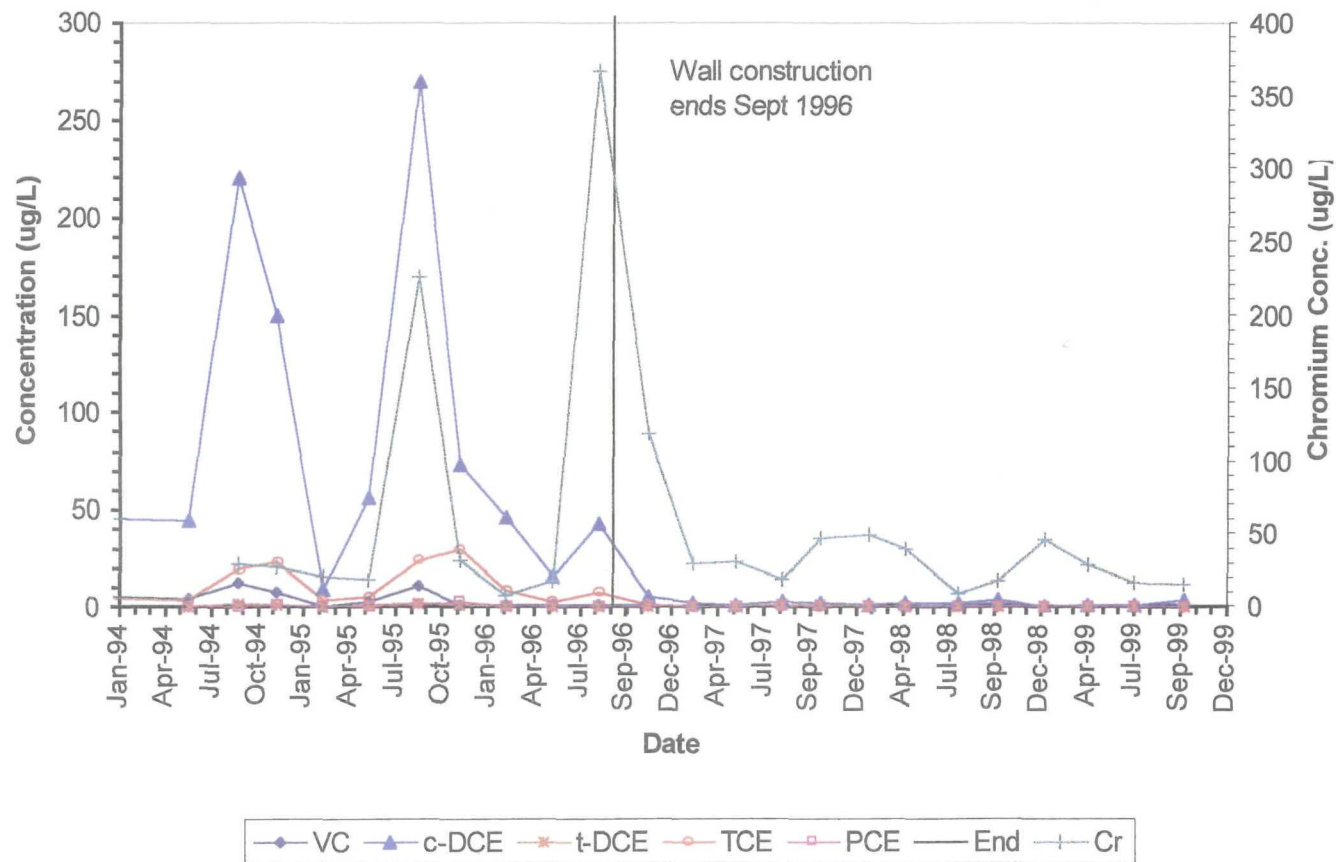
Aquifer 1 Time-series Concentration plots



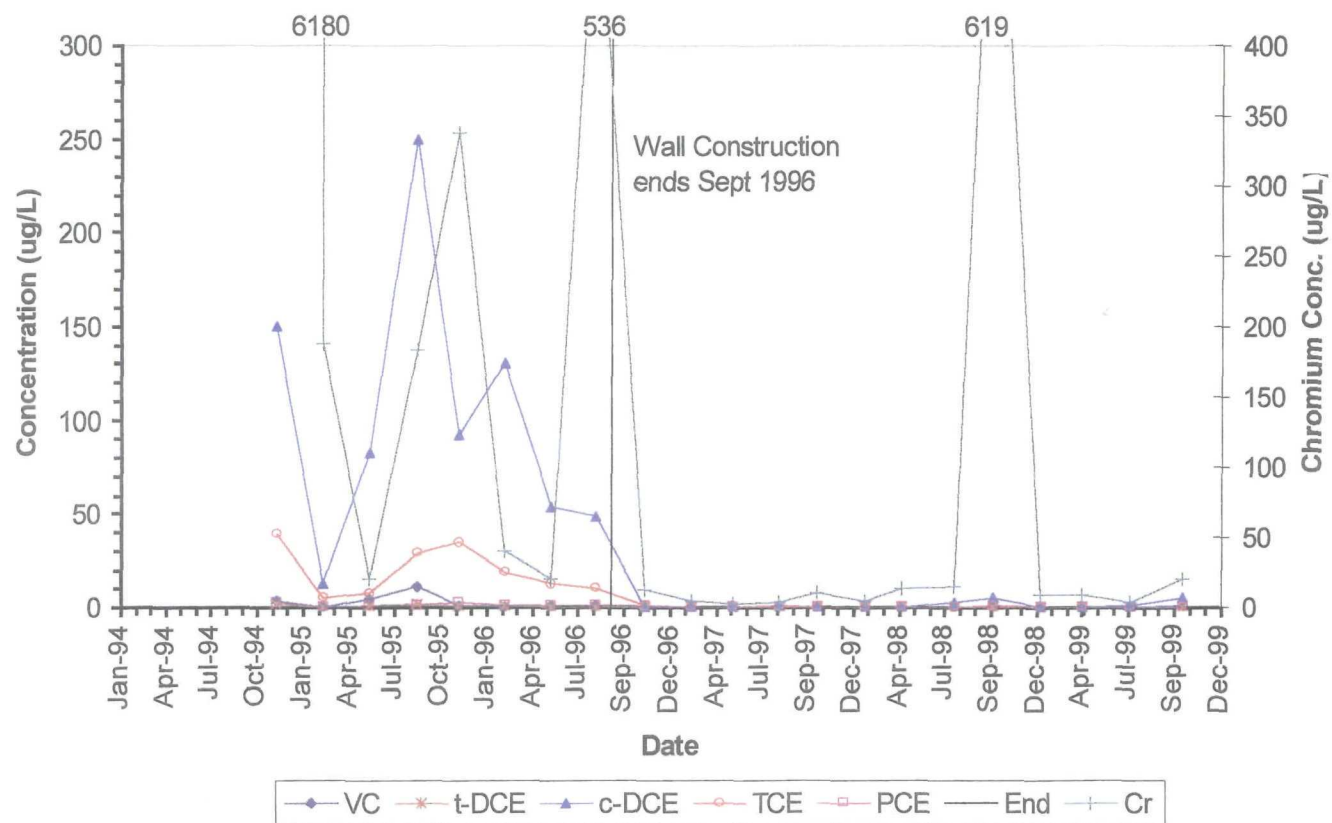
# **B-1** **Aquifer 1**



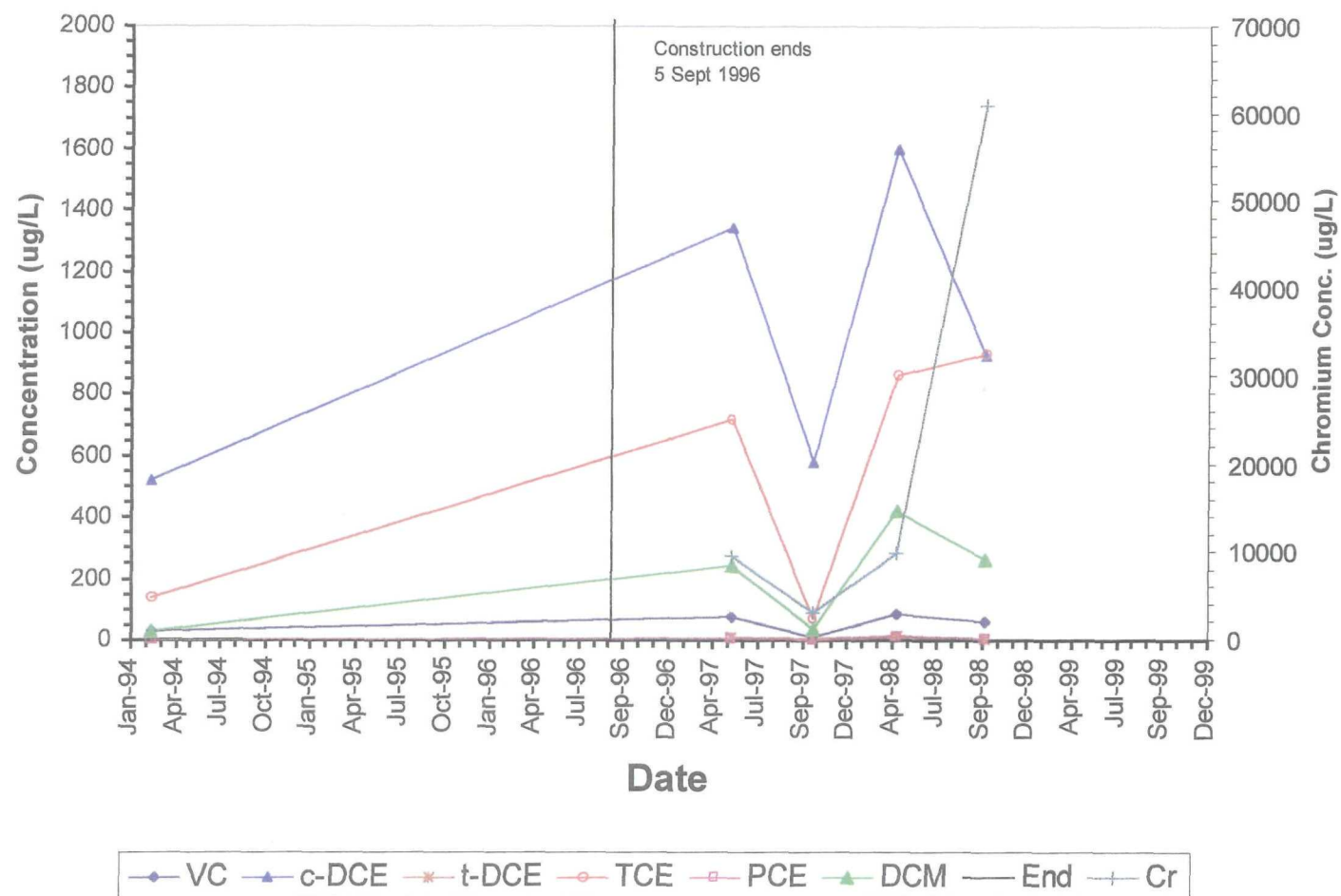
# **E-1** **Aquifer 1**

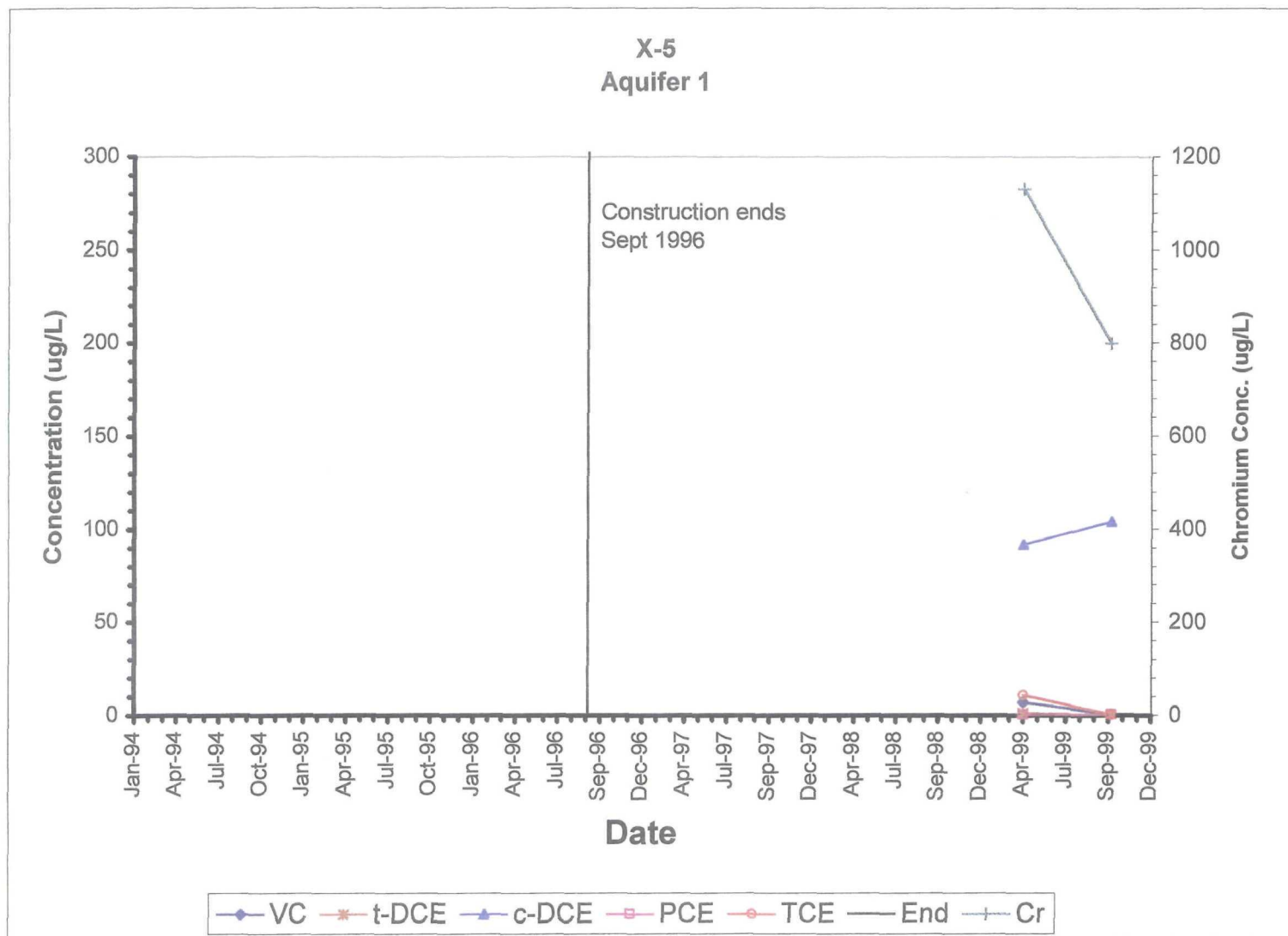


# E-1a Aquifer 1

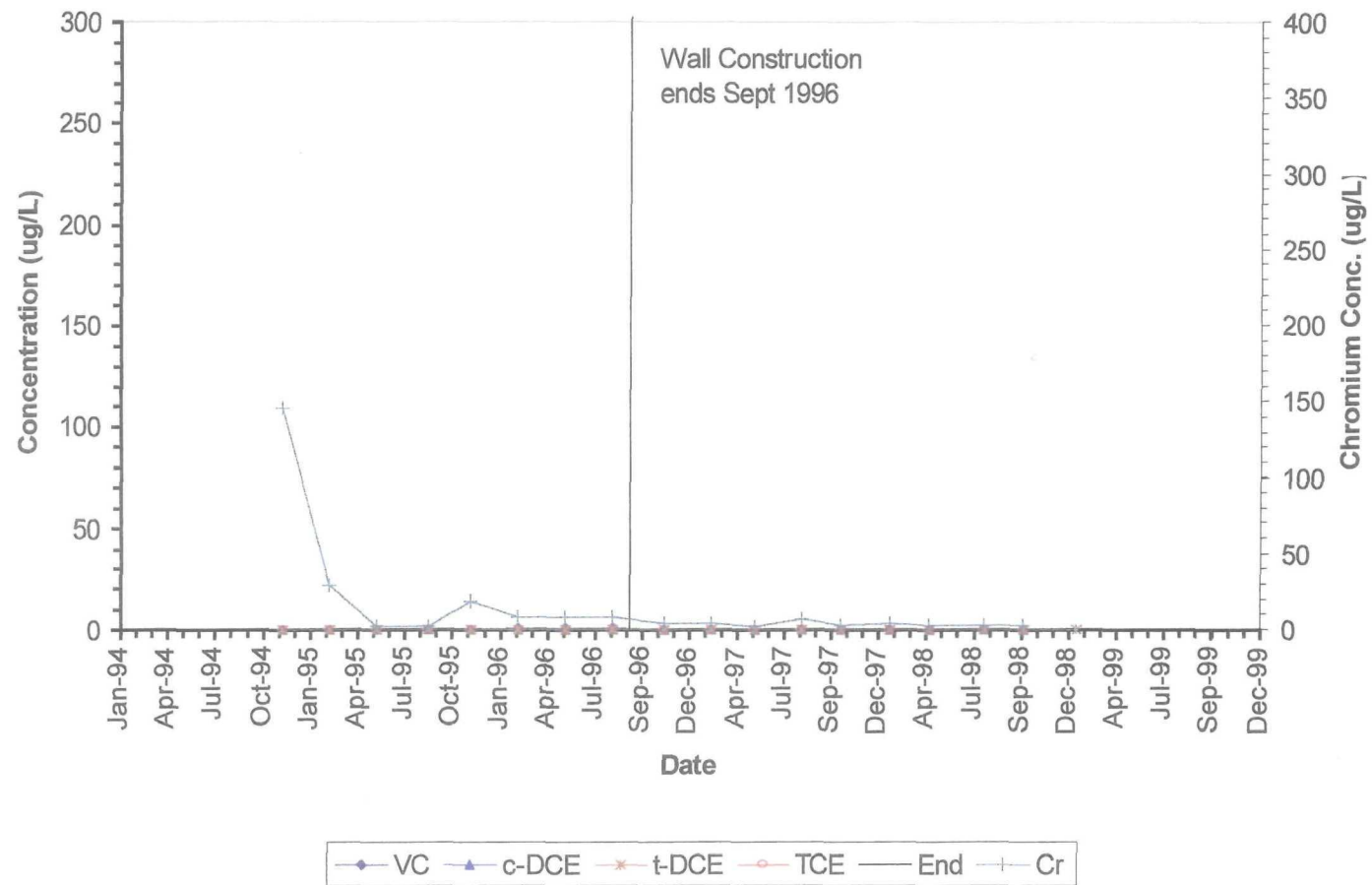


# MW-6 Aquifer 1





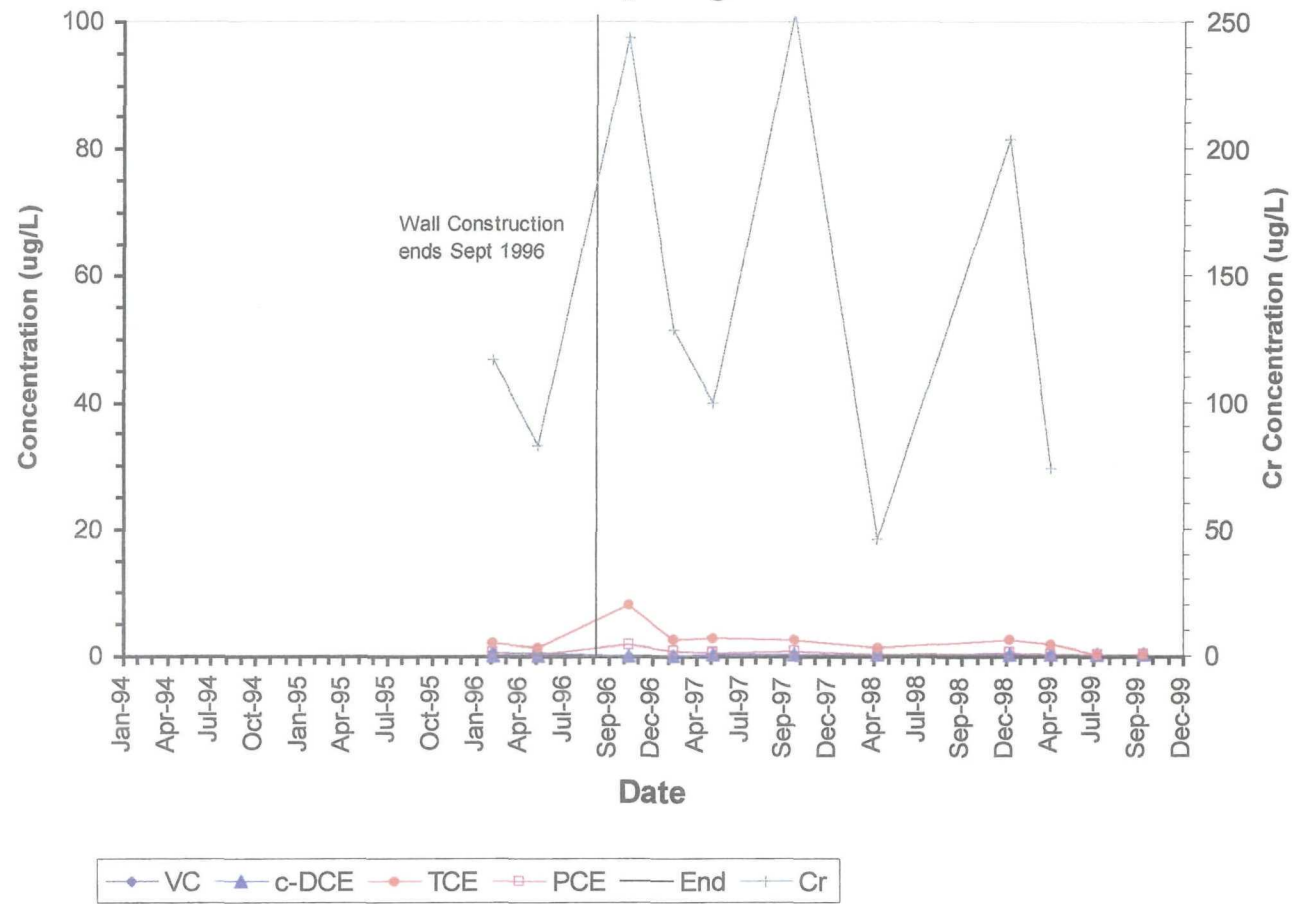
# **Z-1** **Aquifer 1**



## APPENDIX B

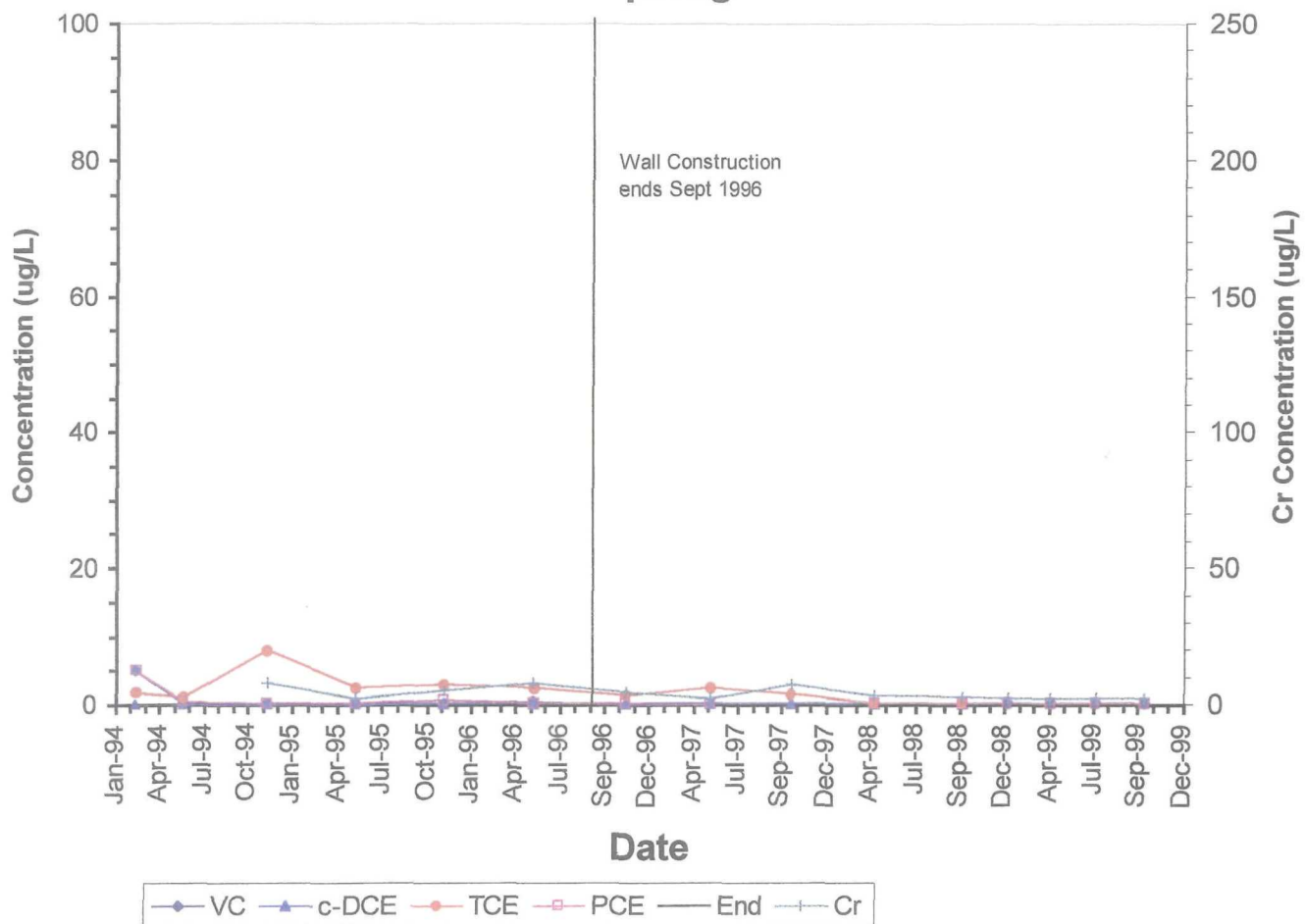
### Spring Time-series Concentration Plots

# SP-5 Spring





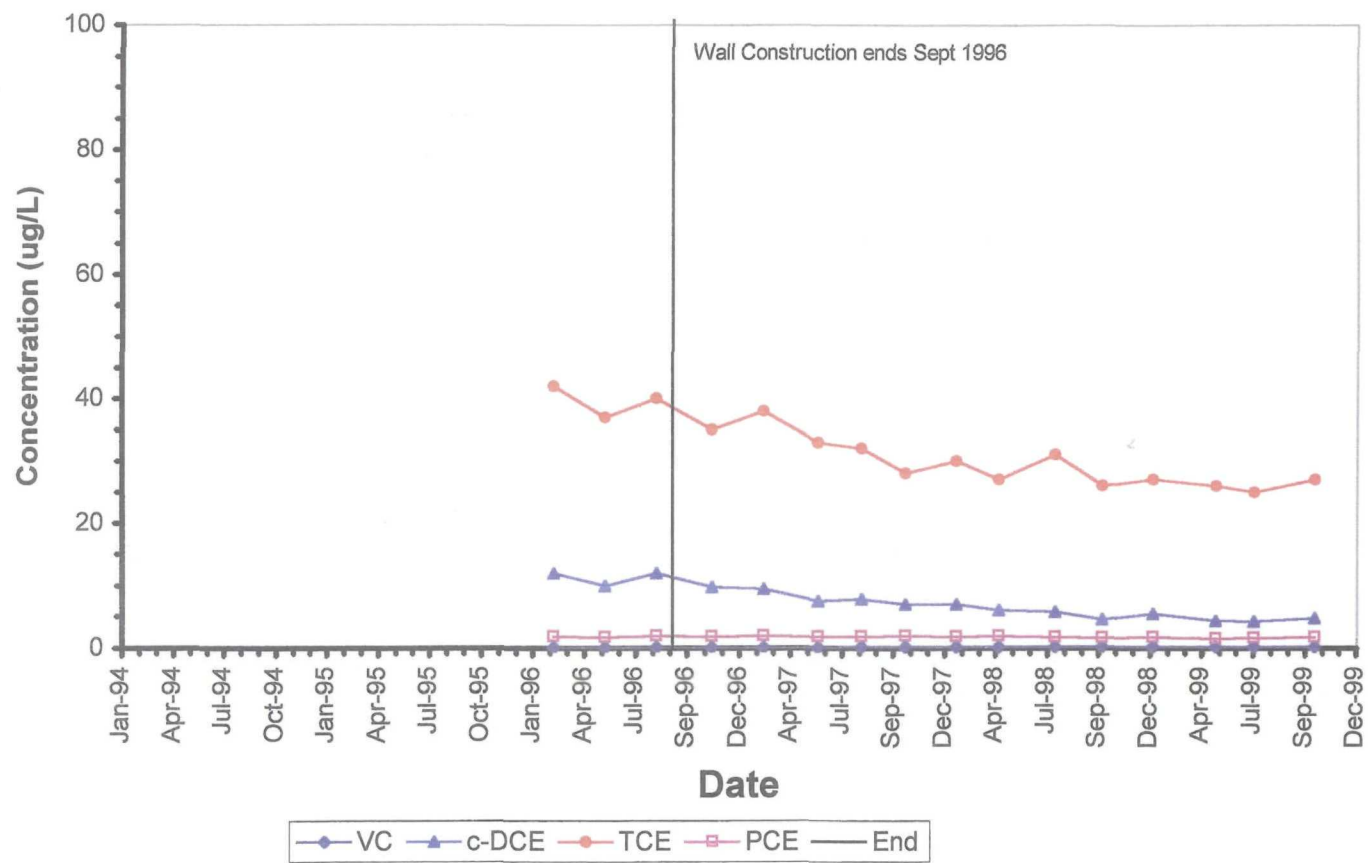
## EC-2 Spring



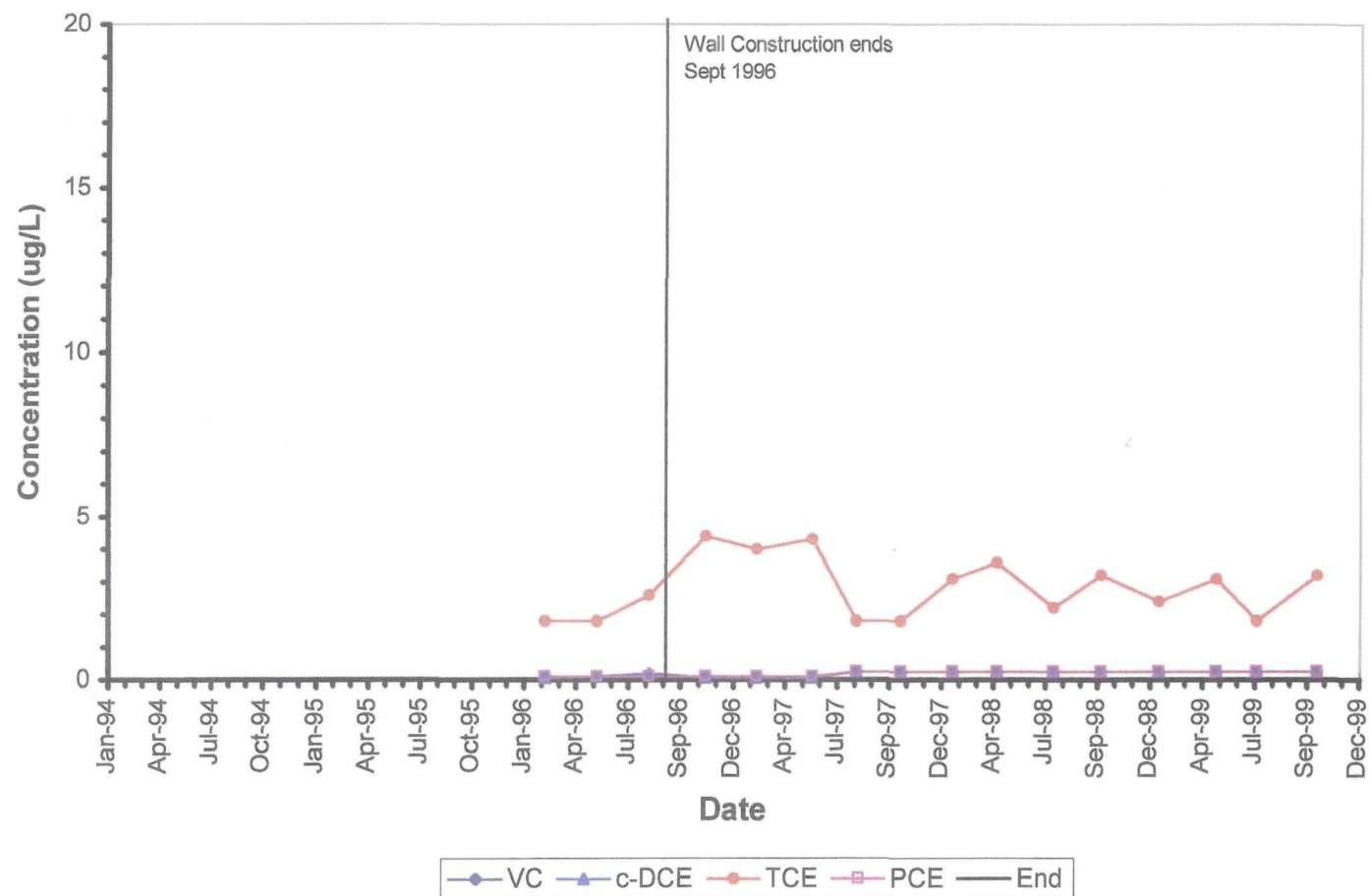
APPENDIX C

Upper Aquifer 2 Time-series Concentration Pots

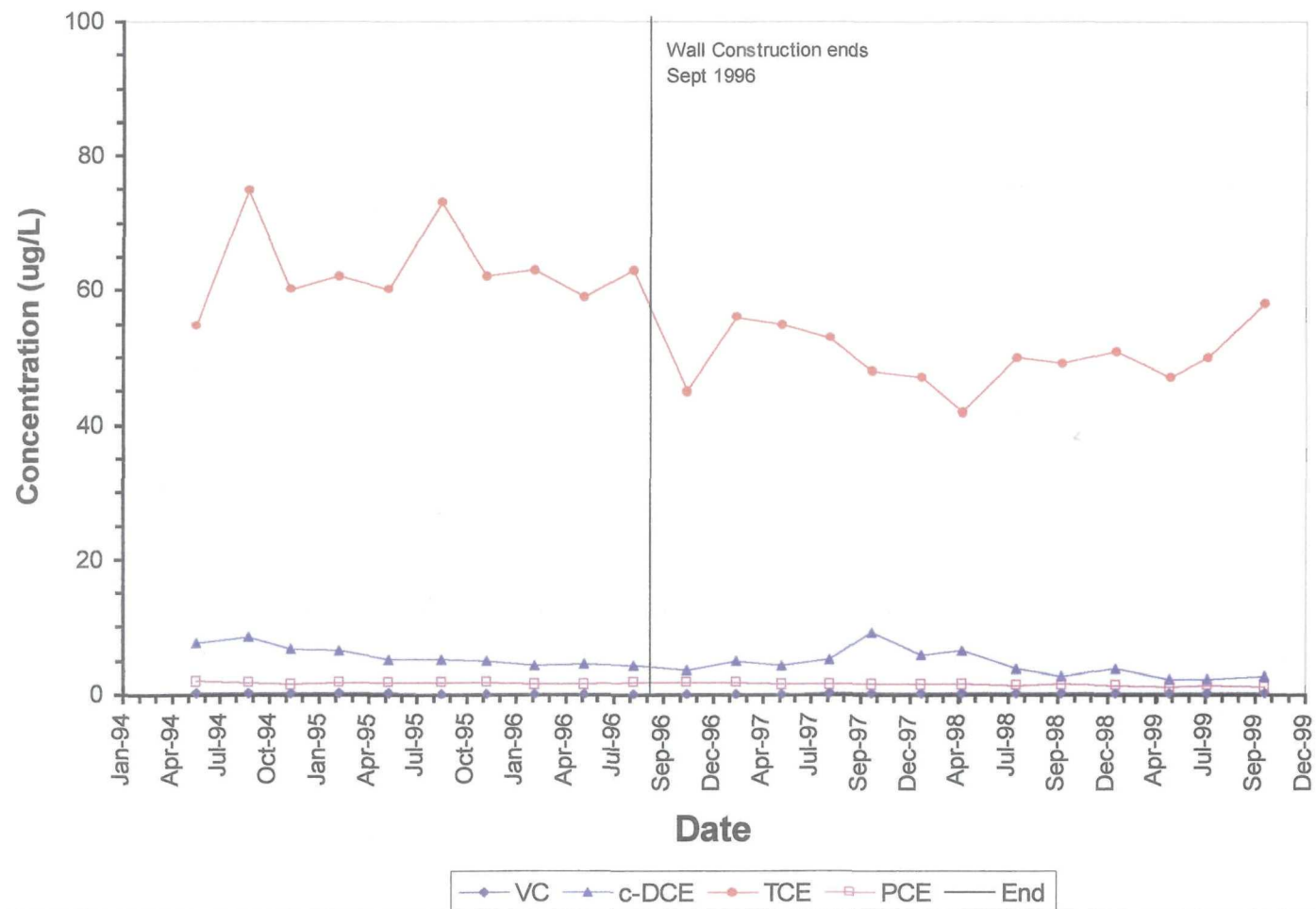
**C-2a**  
**Upper Aquifer 2**



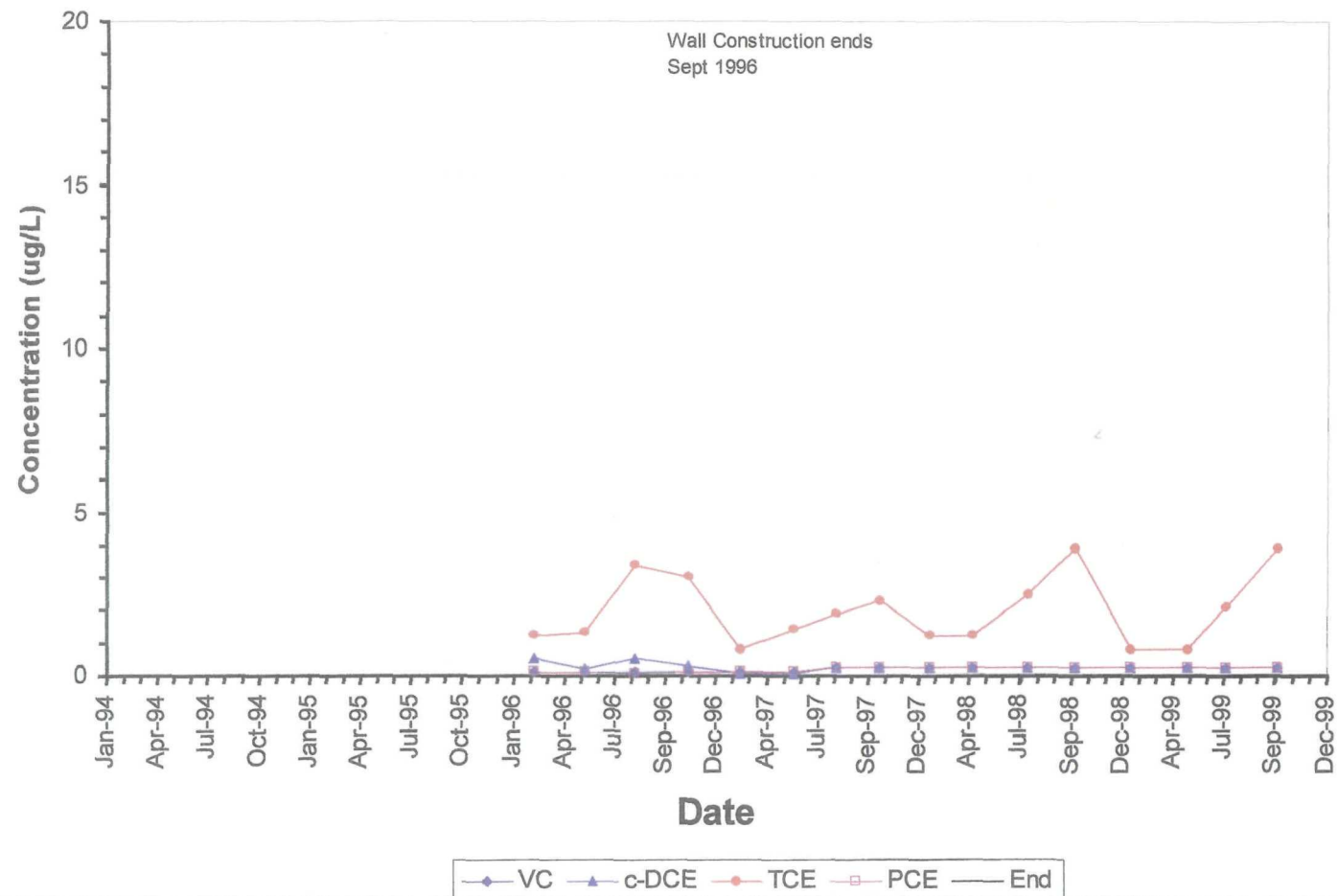
# D-2a Upper Aquifer 2



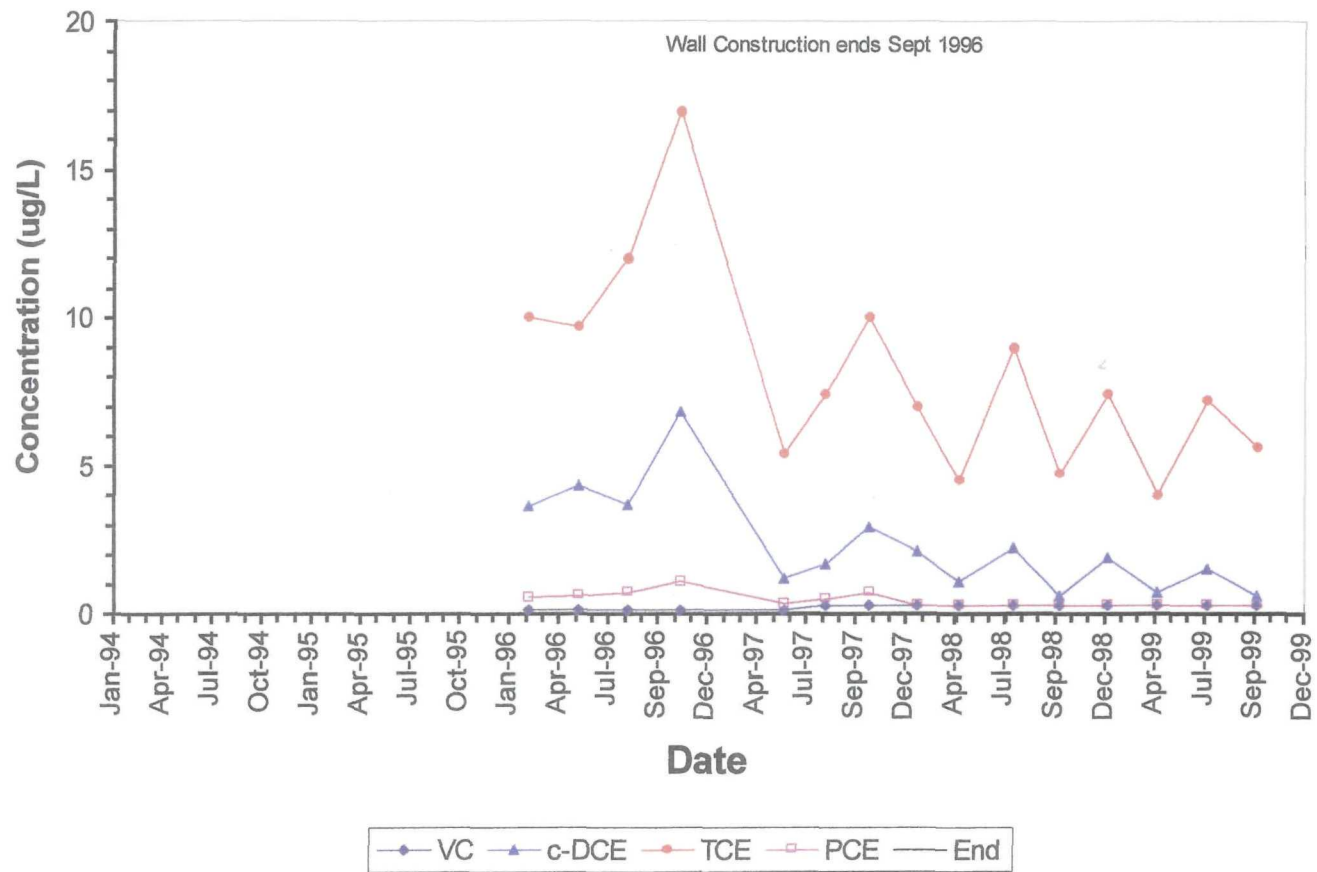
# **E-2a** **Upper Aquifer 2**



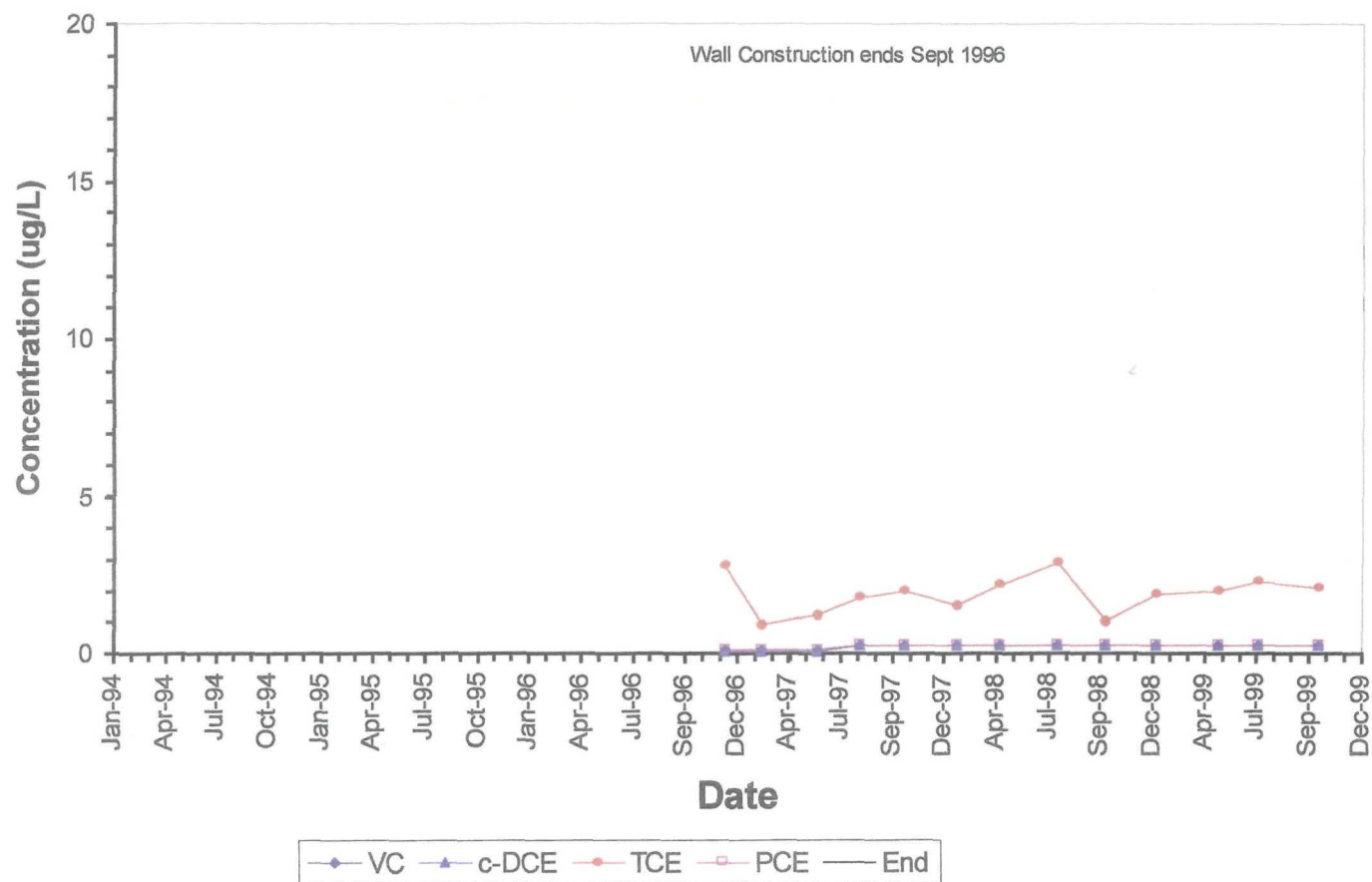
F-2a  
Upper Aquifer 2



**G-2a  
Upper Aquifer 2**

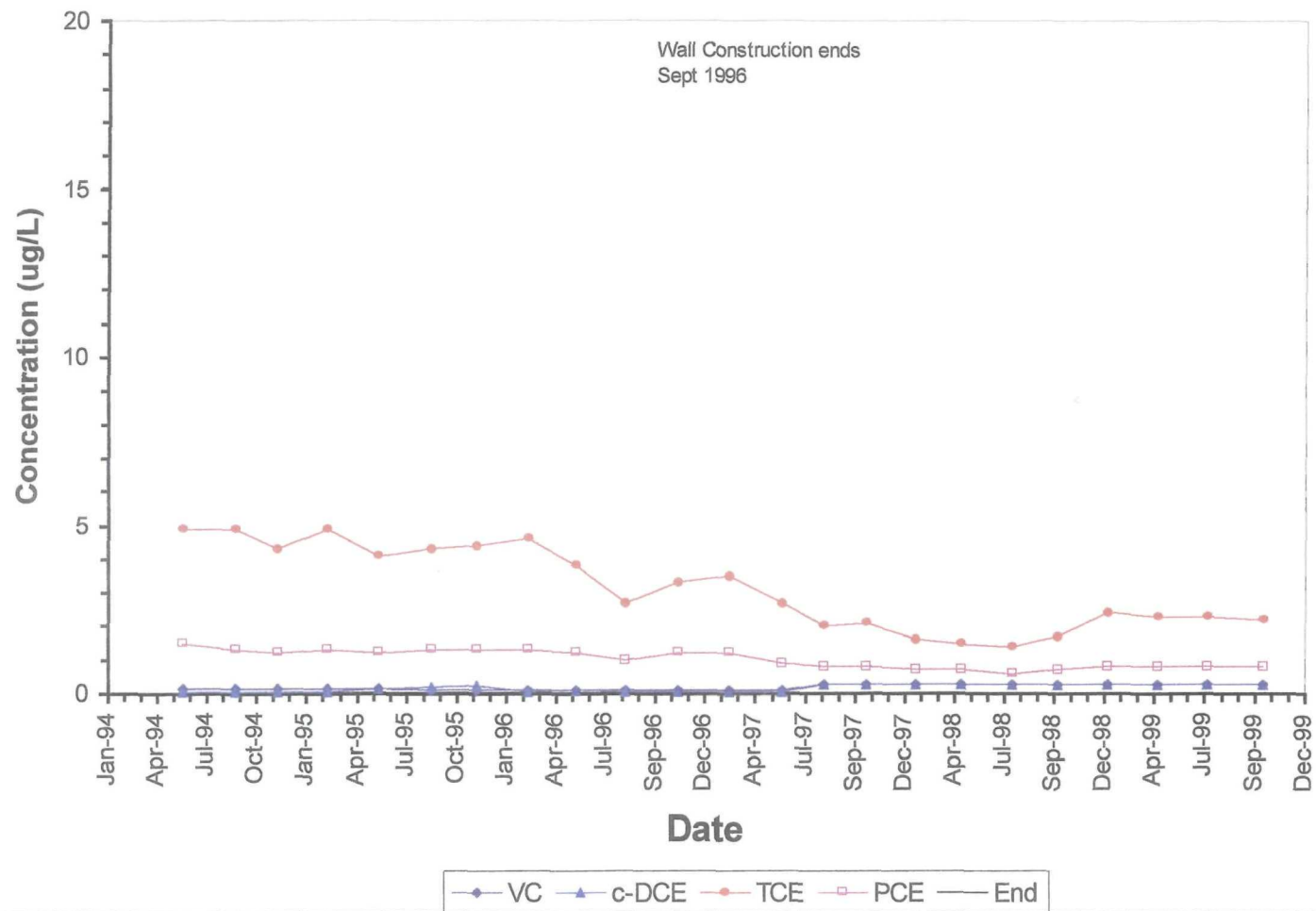


## H-2a Upper Aquifer 2

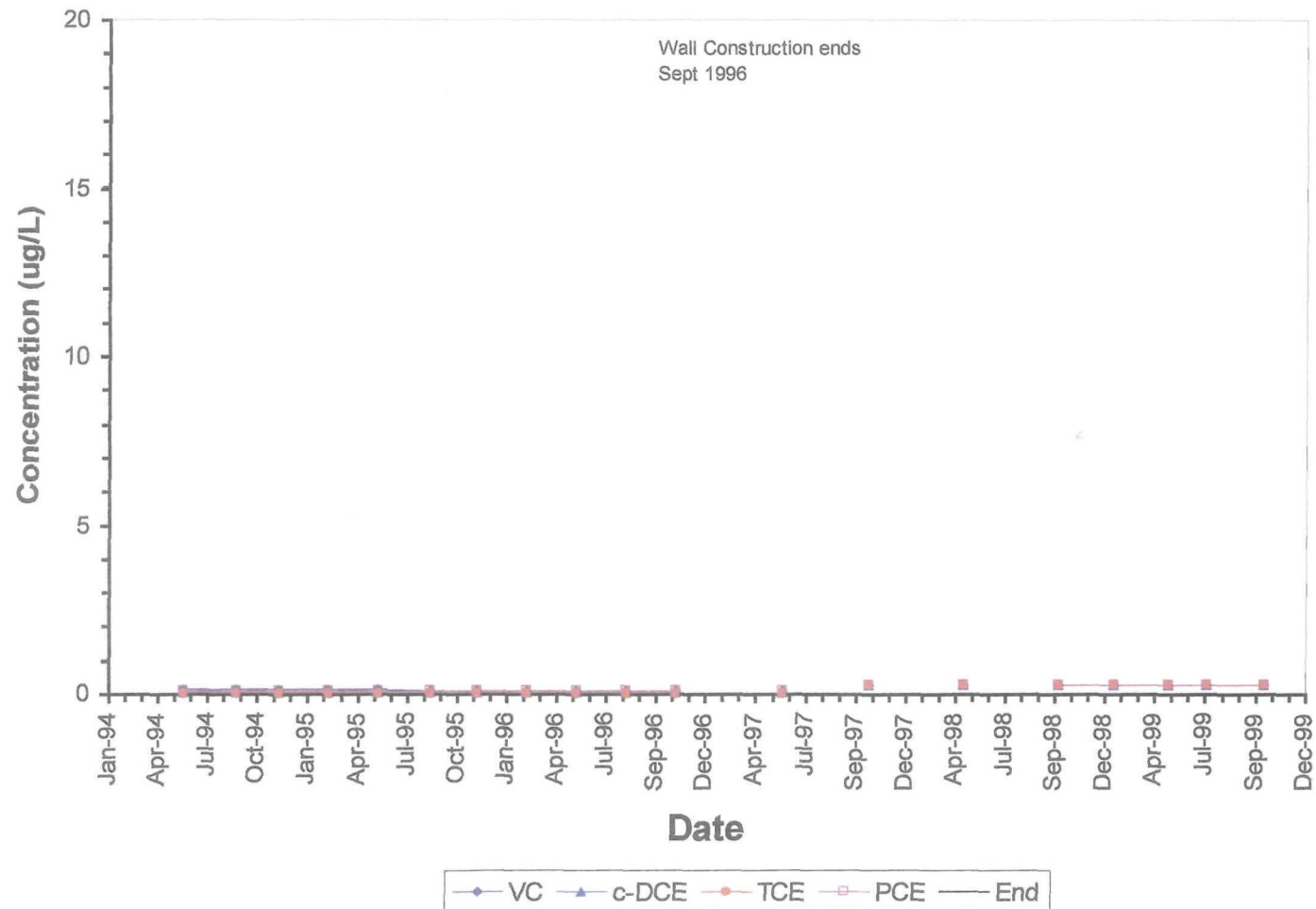




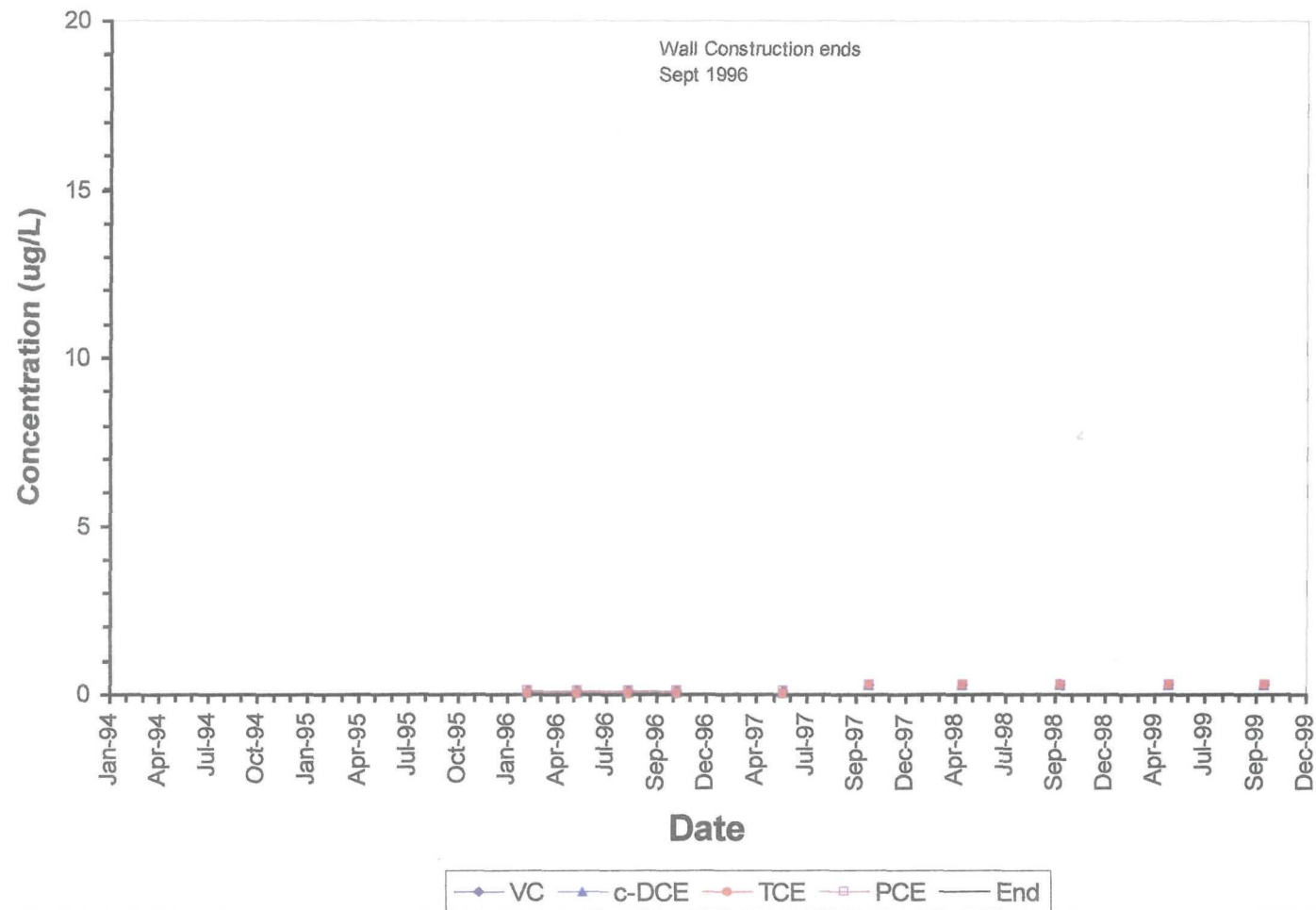
I-2a  
Upper Aquifer 2



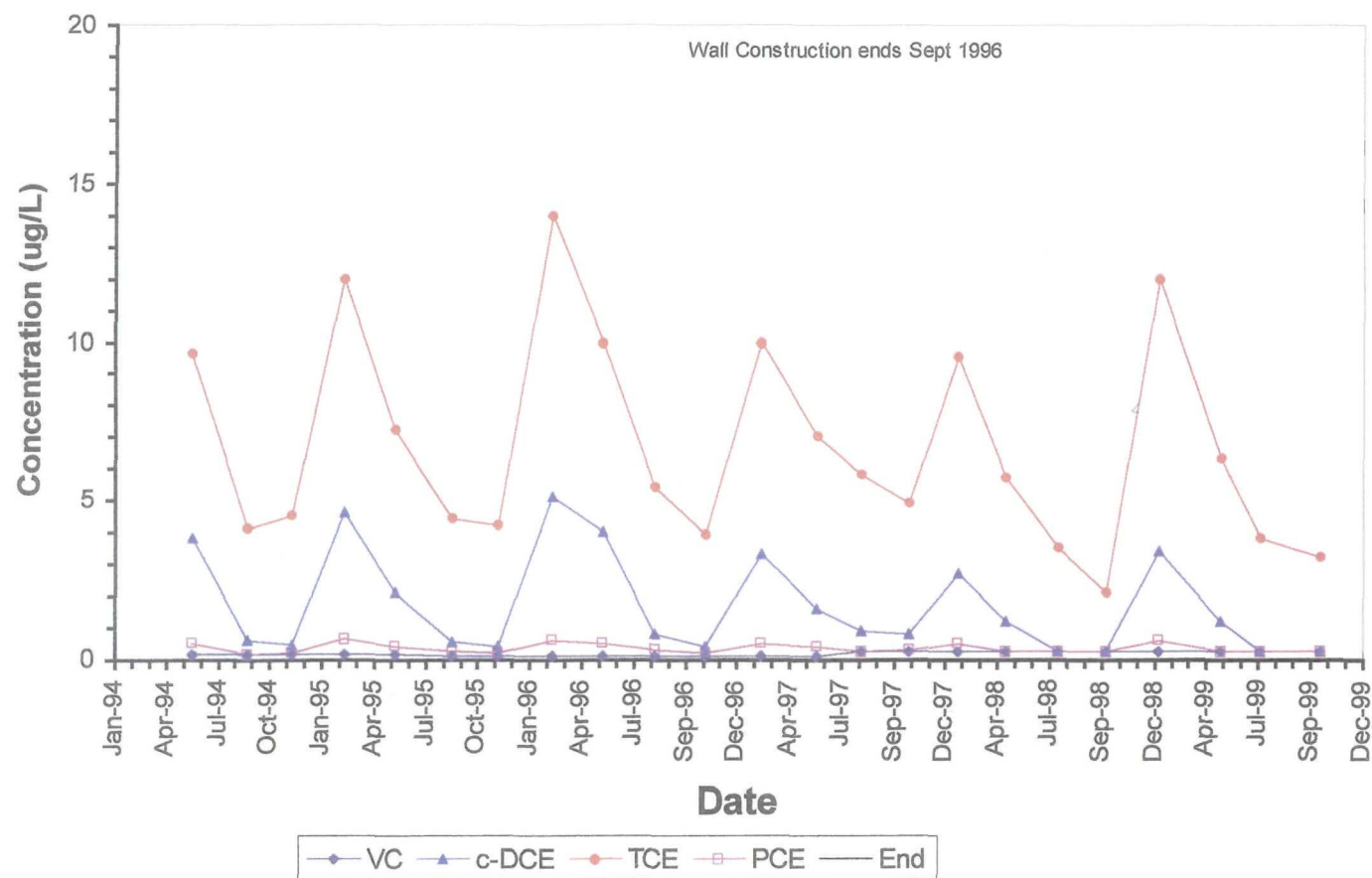
**J-2a**  
**Upper Aquifer 2**



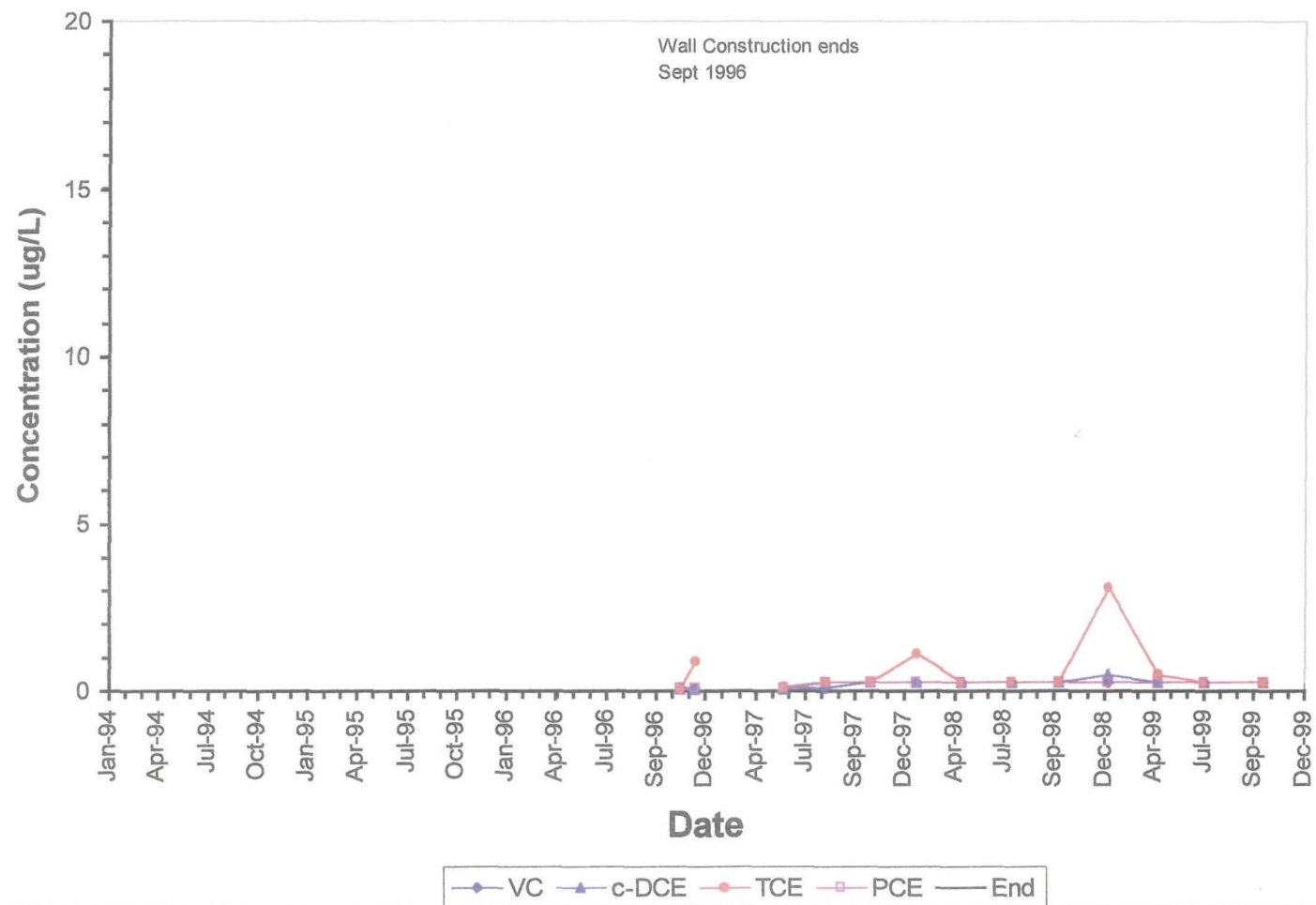
**K-2a**  
**Upper Aquifer 2**



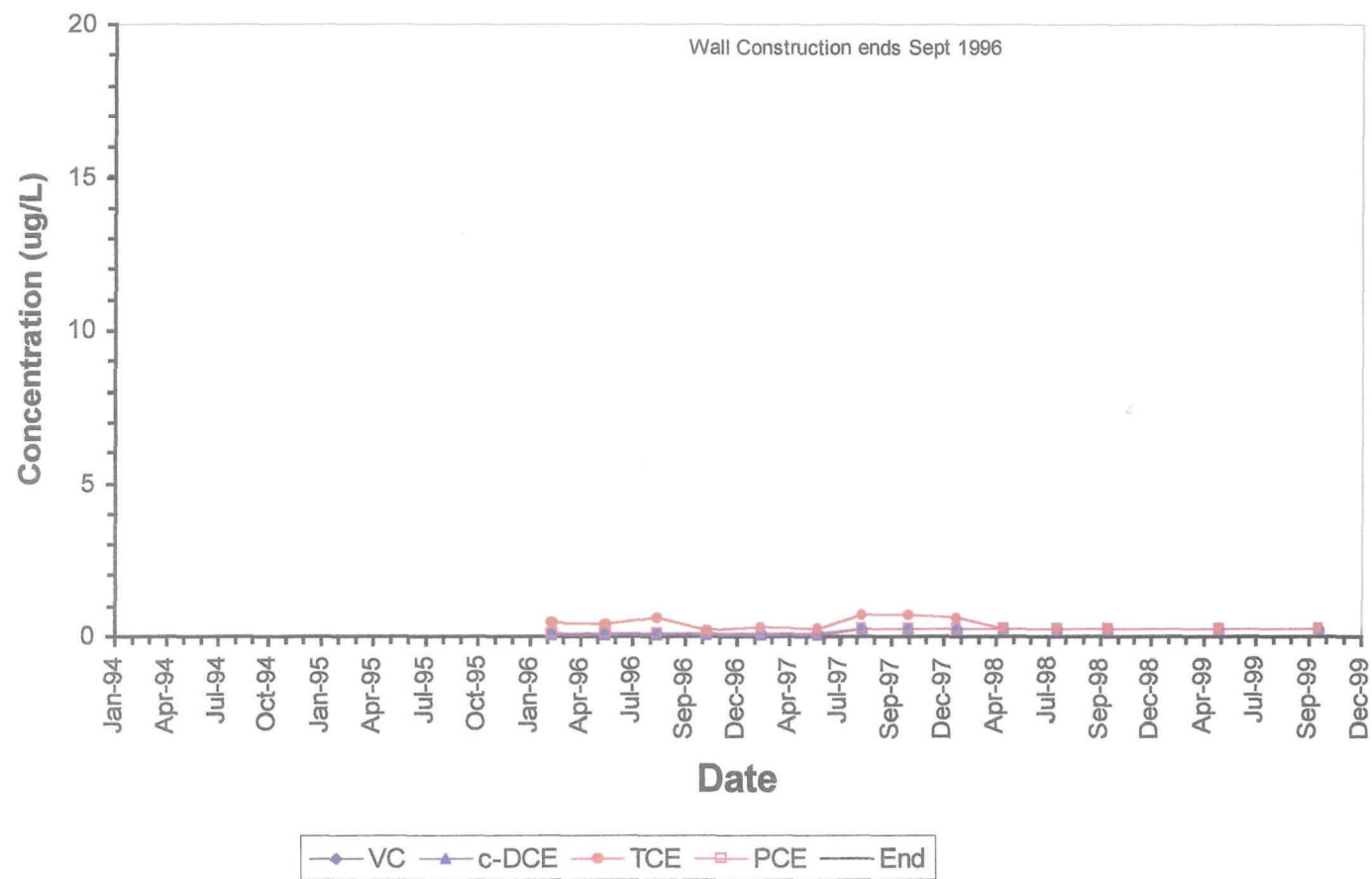
**L-2a  
Upper Aquifer 2**



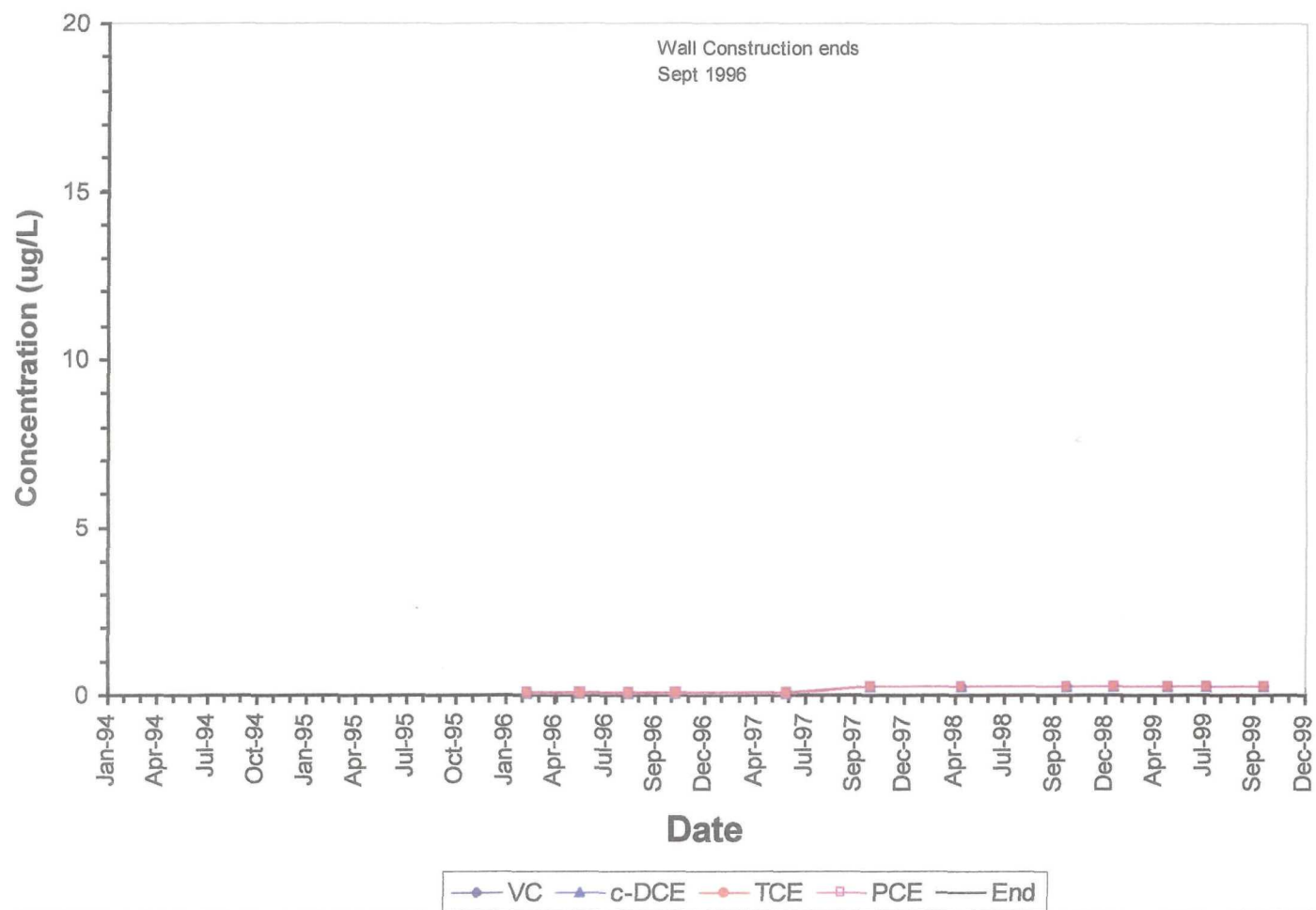
**M-2a**  
**Upper Aquifer 2**



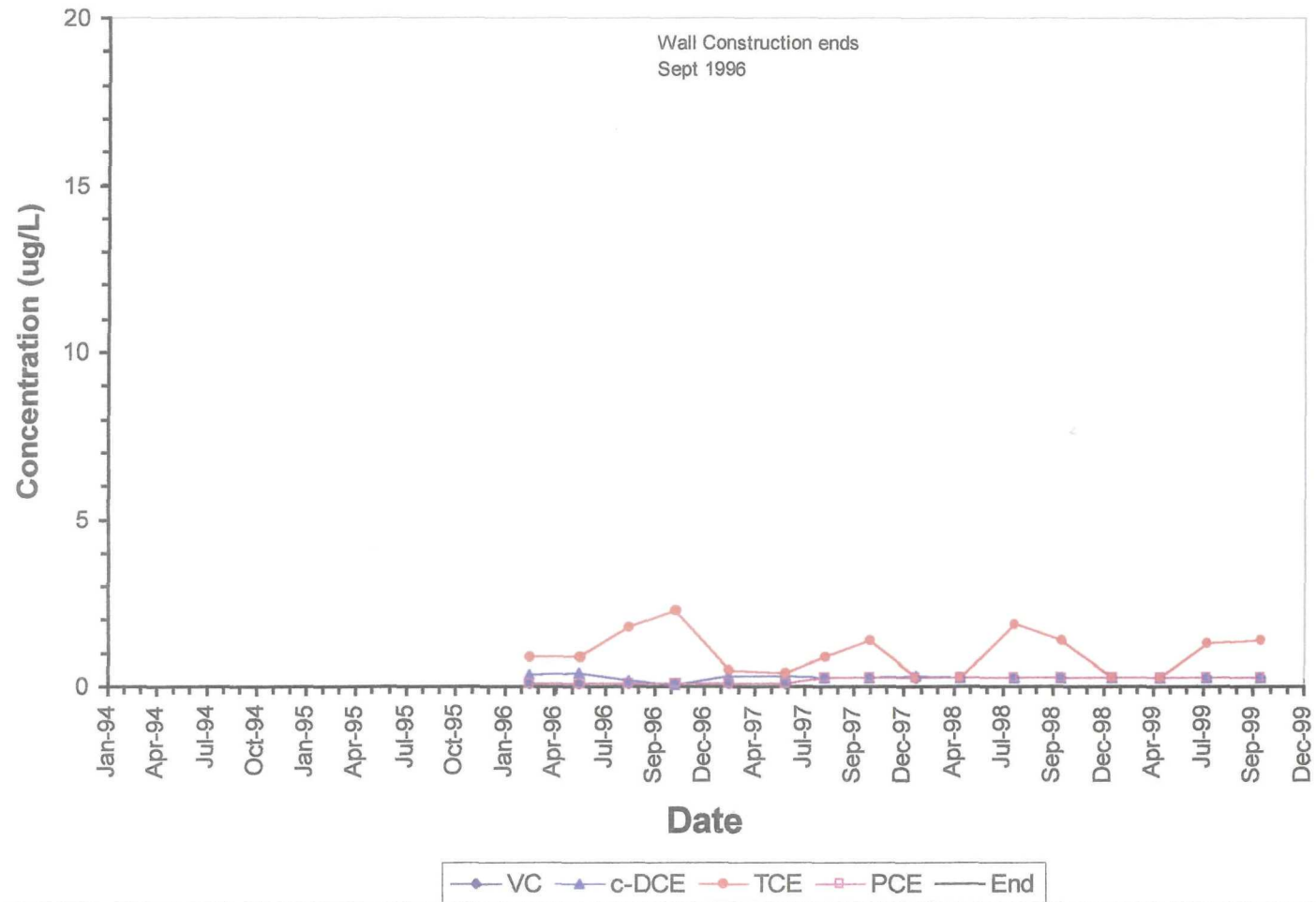
N-2a  
Upper Aquifer 2



**O-2a**  
**Upper Aquifer 2**

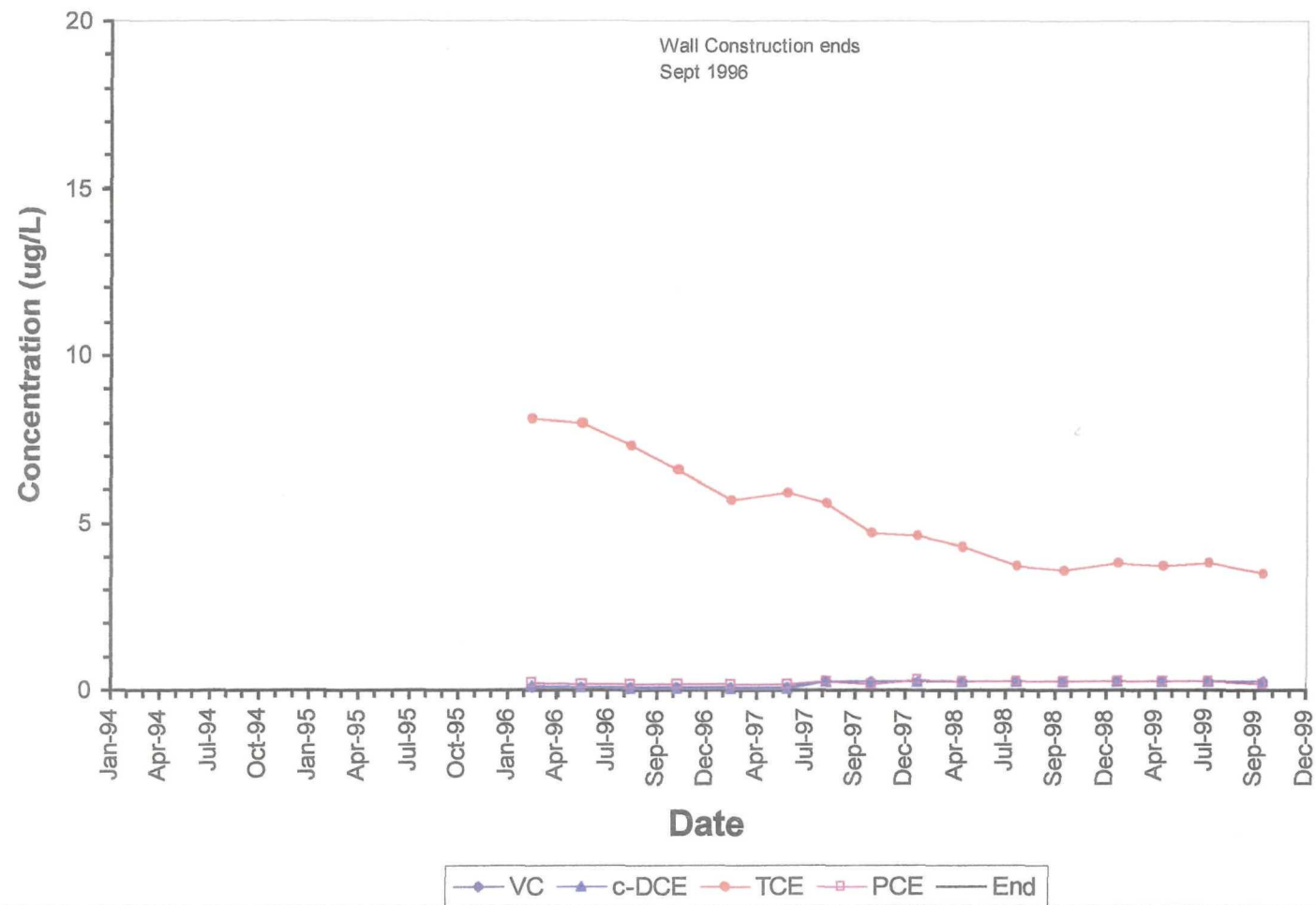


**R-2a  
Upper Aquifer 2**

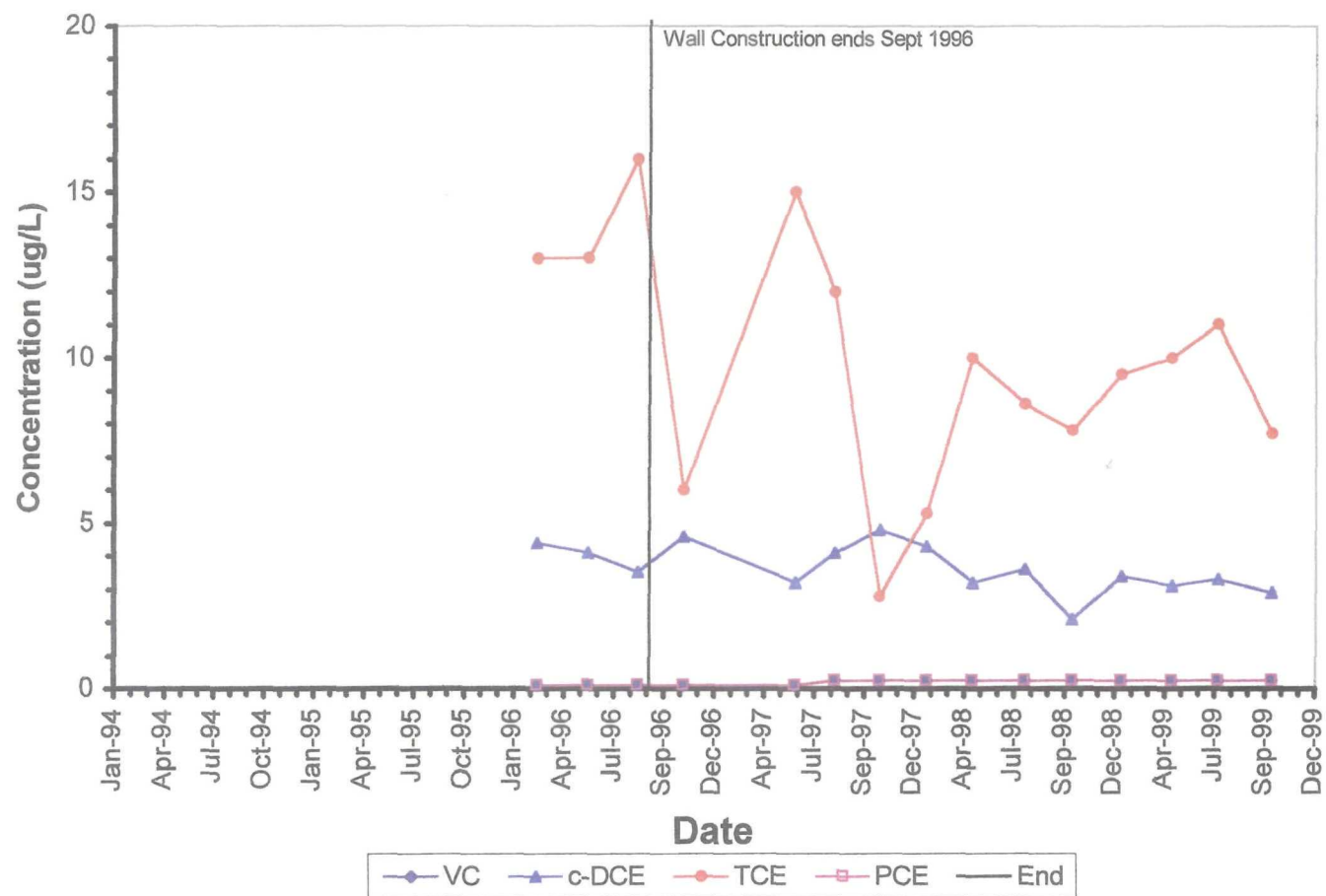




**S-2a**  
**Upper Aquifer 2**



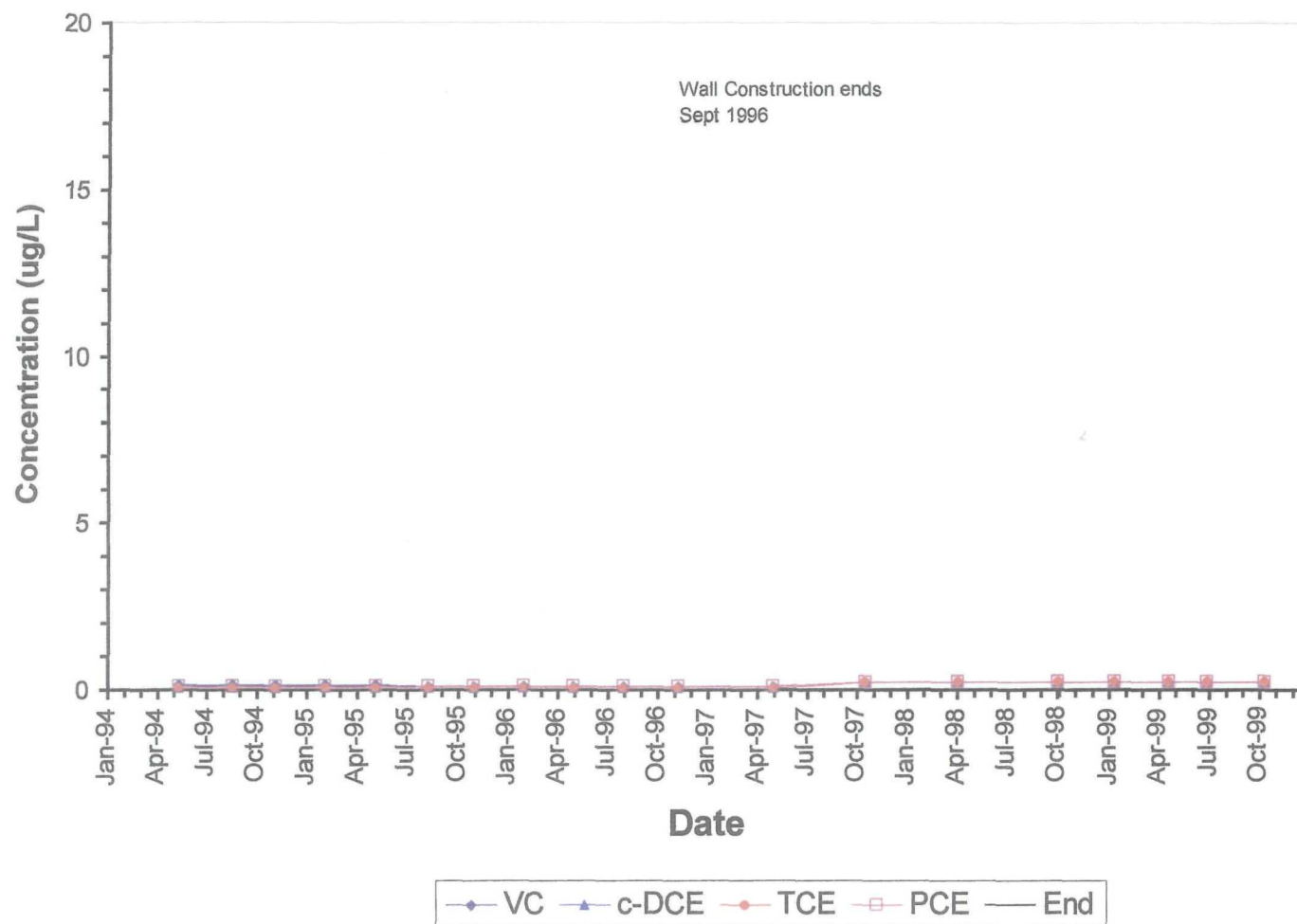
**V-2a  
Upper Aquifer 2**



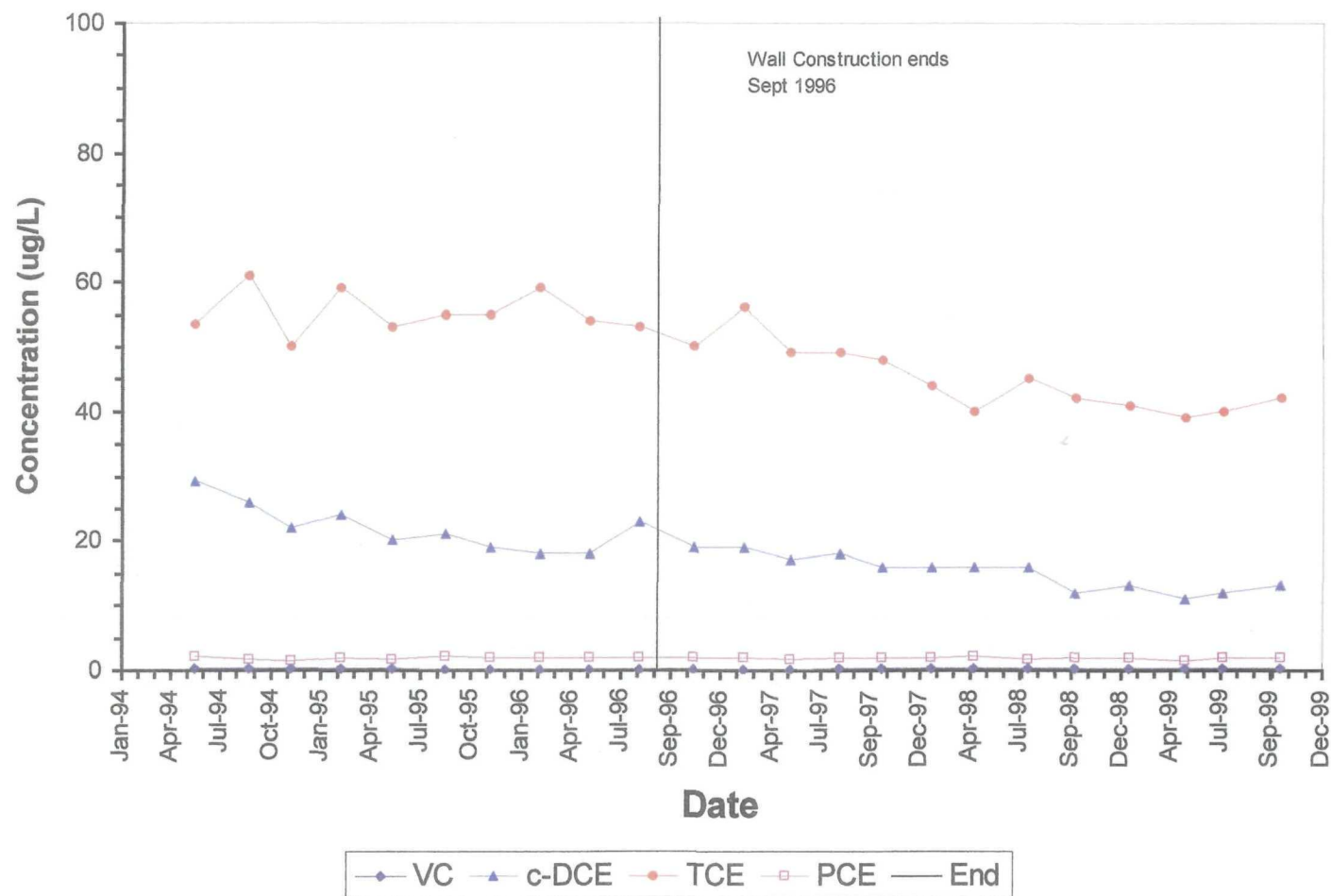
APPENDIX D

Lower Aquifer 2 Time-series Concentration Plots

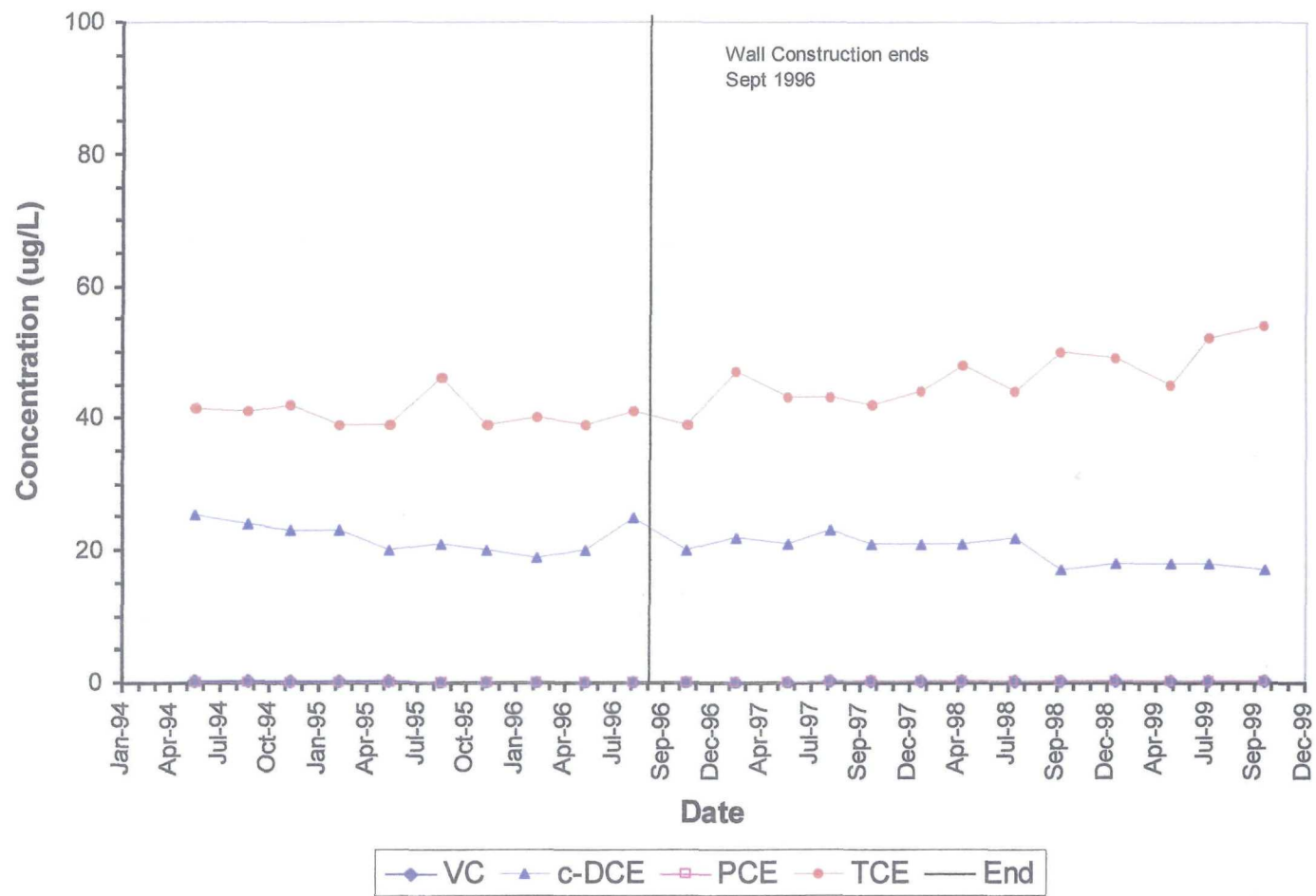
**A-2**  
**Aquifer 2**



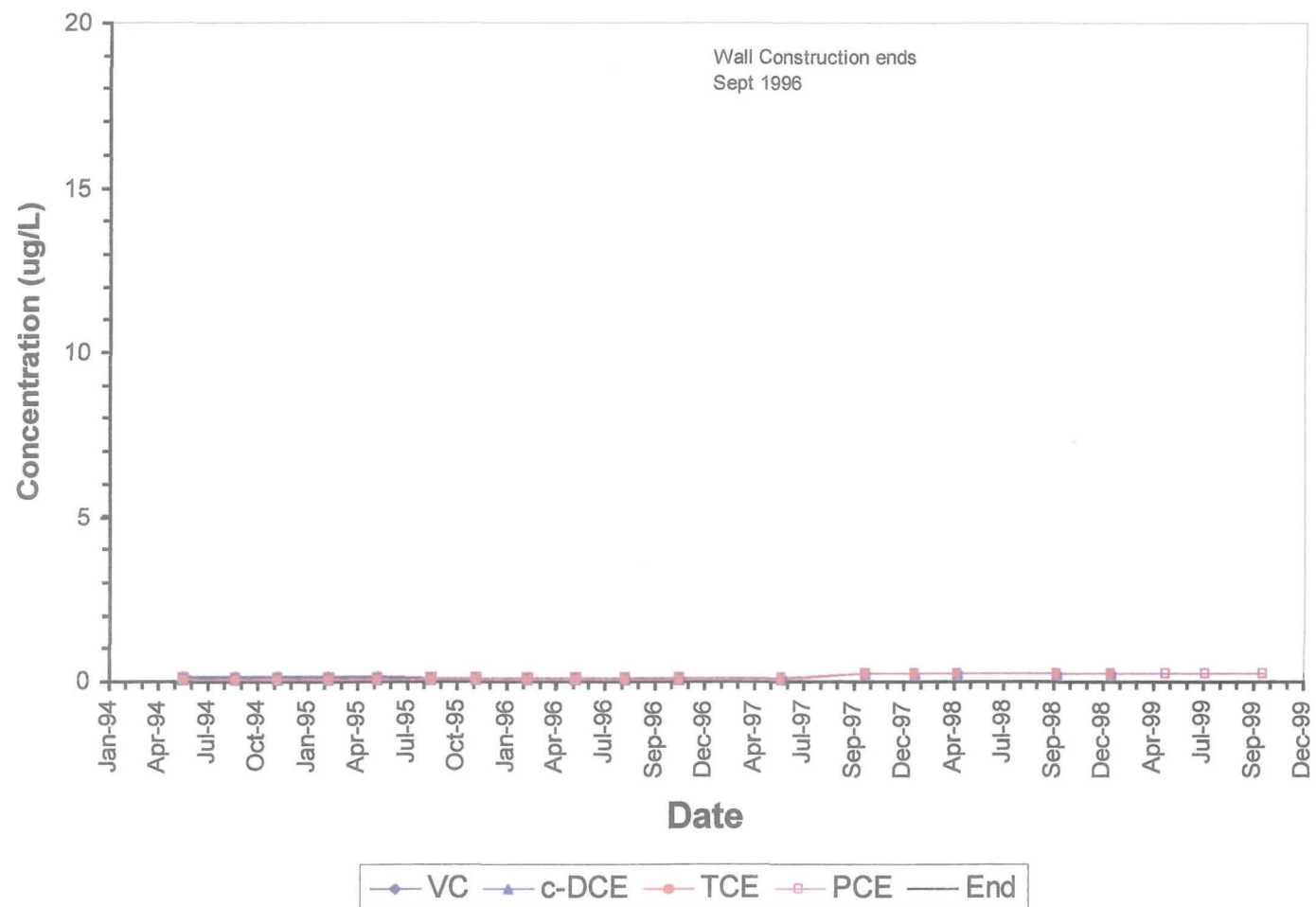
**B-2**  
**Aquifer 2**

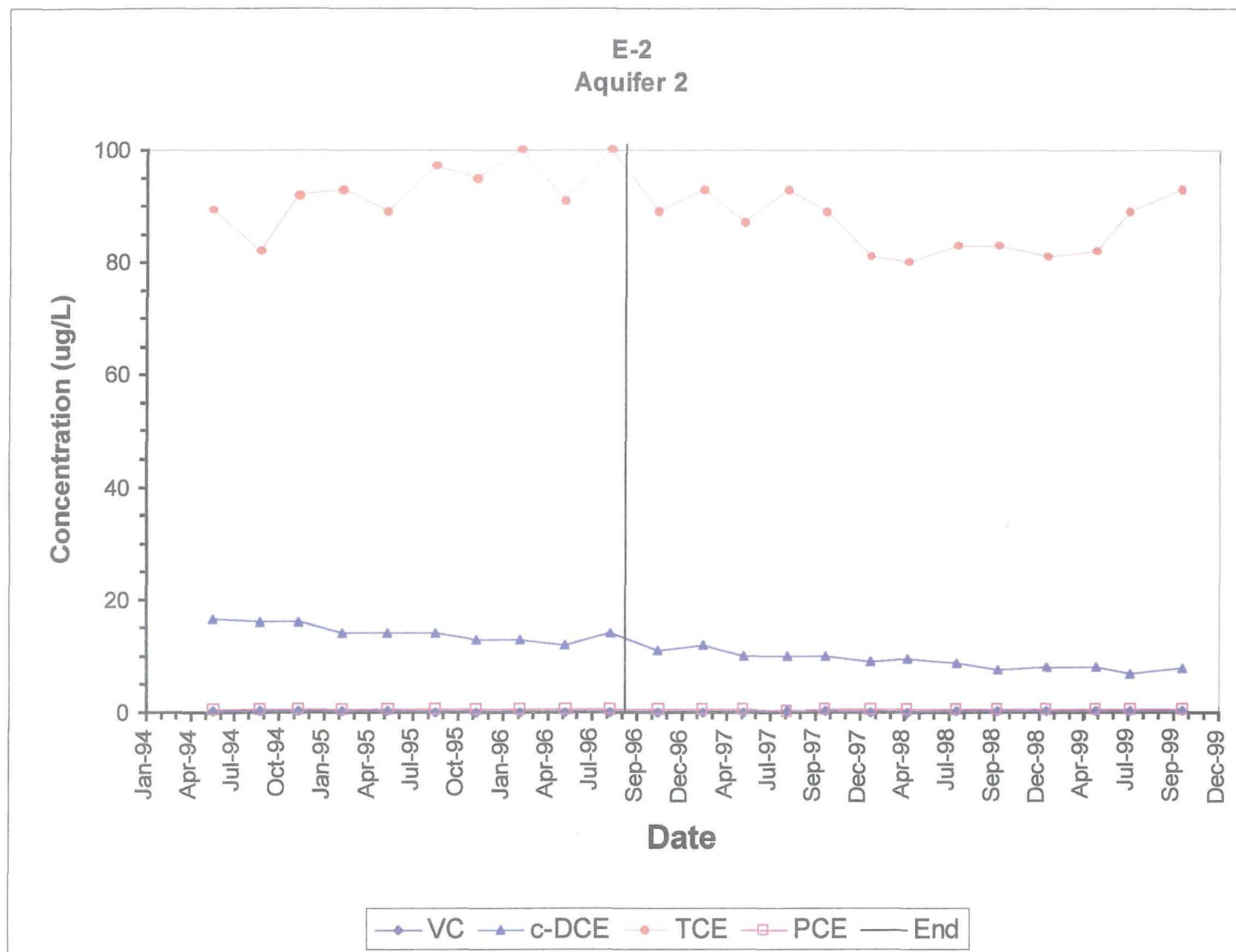


# **C-2** **Aquifer 2**



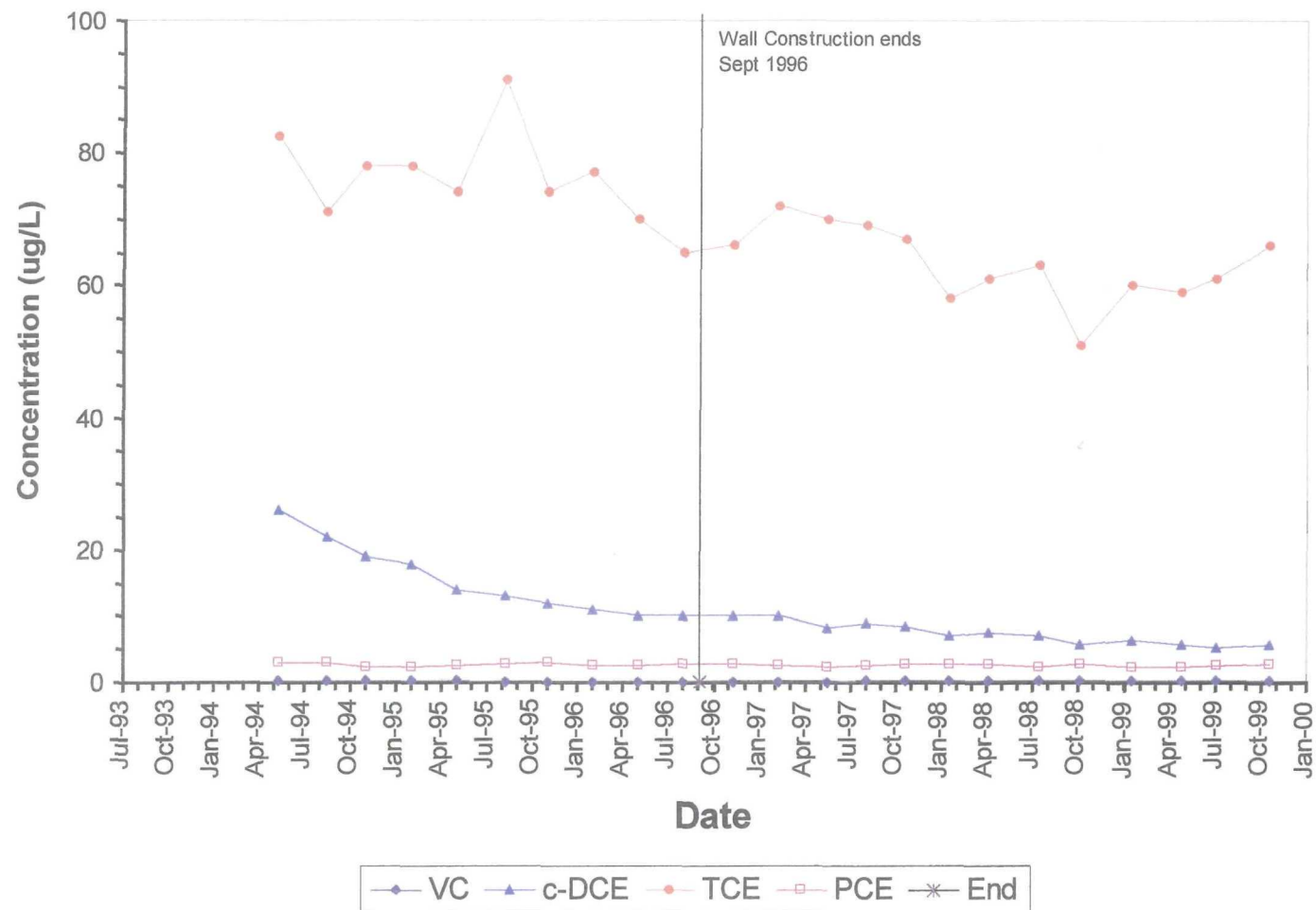
**D-2  
Aquifer 2**



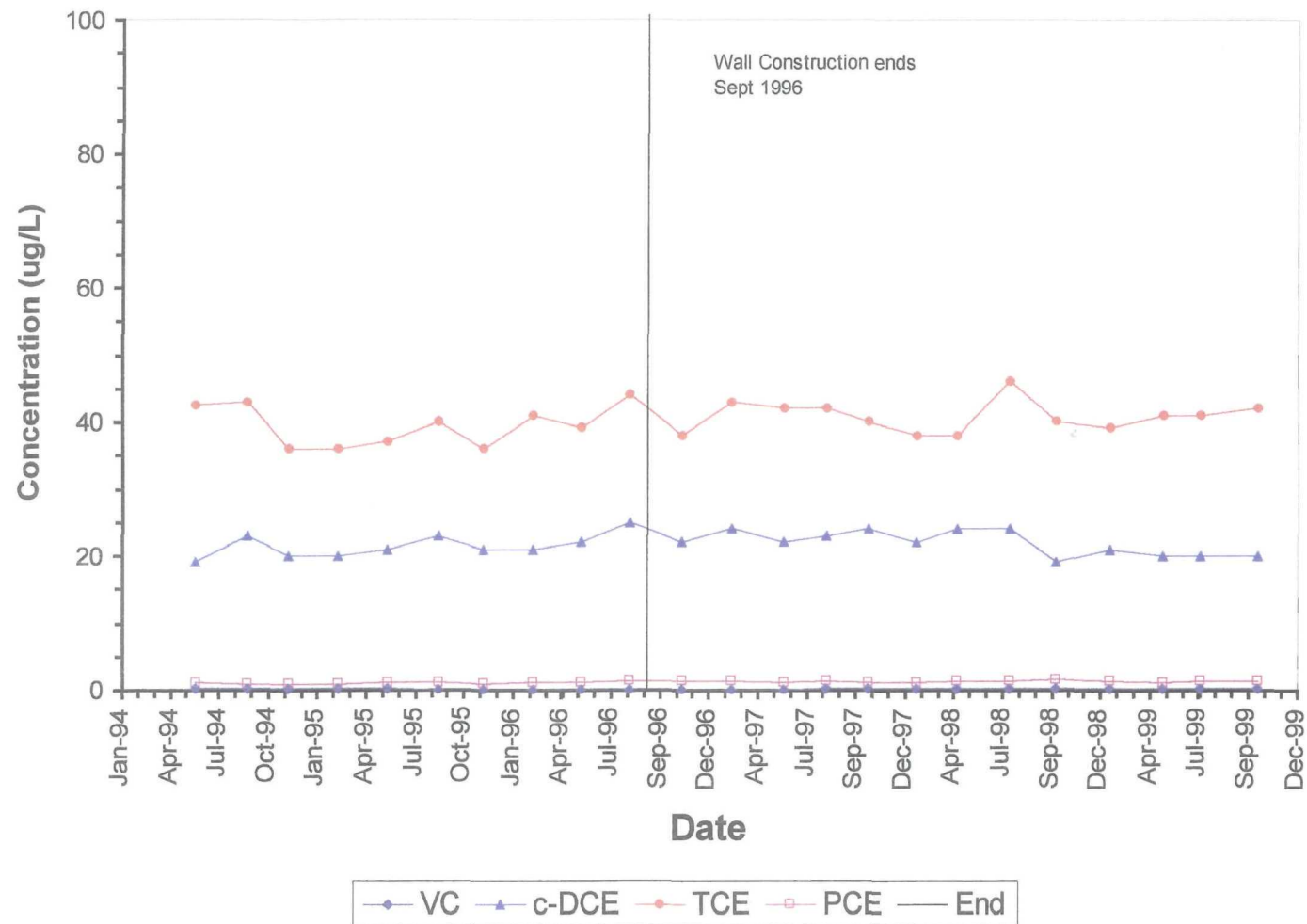




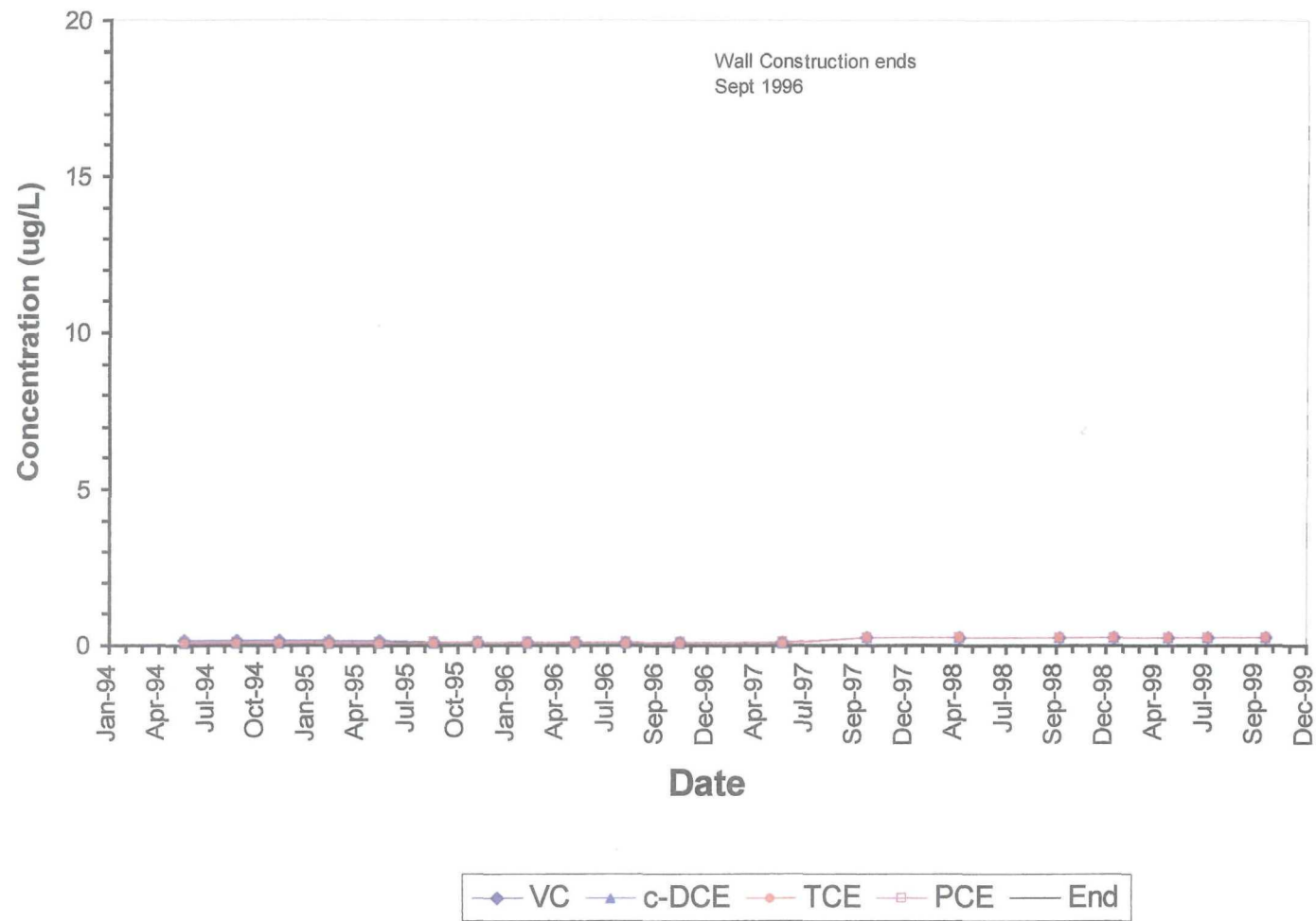
# F-2 Aquifer 2



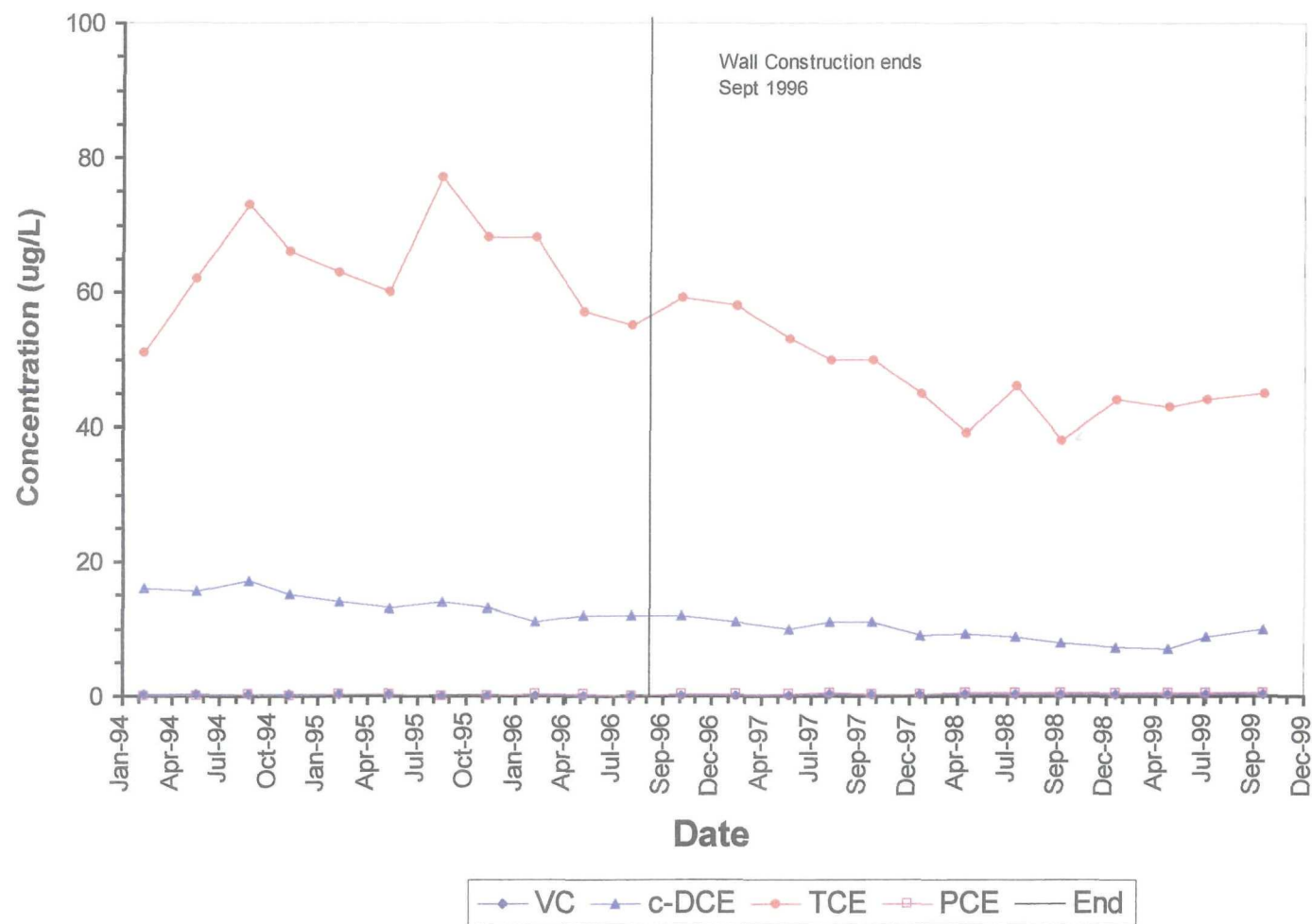
# **G-2 Aquifer 2**



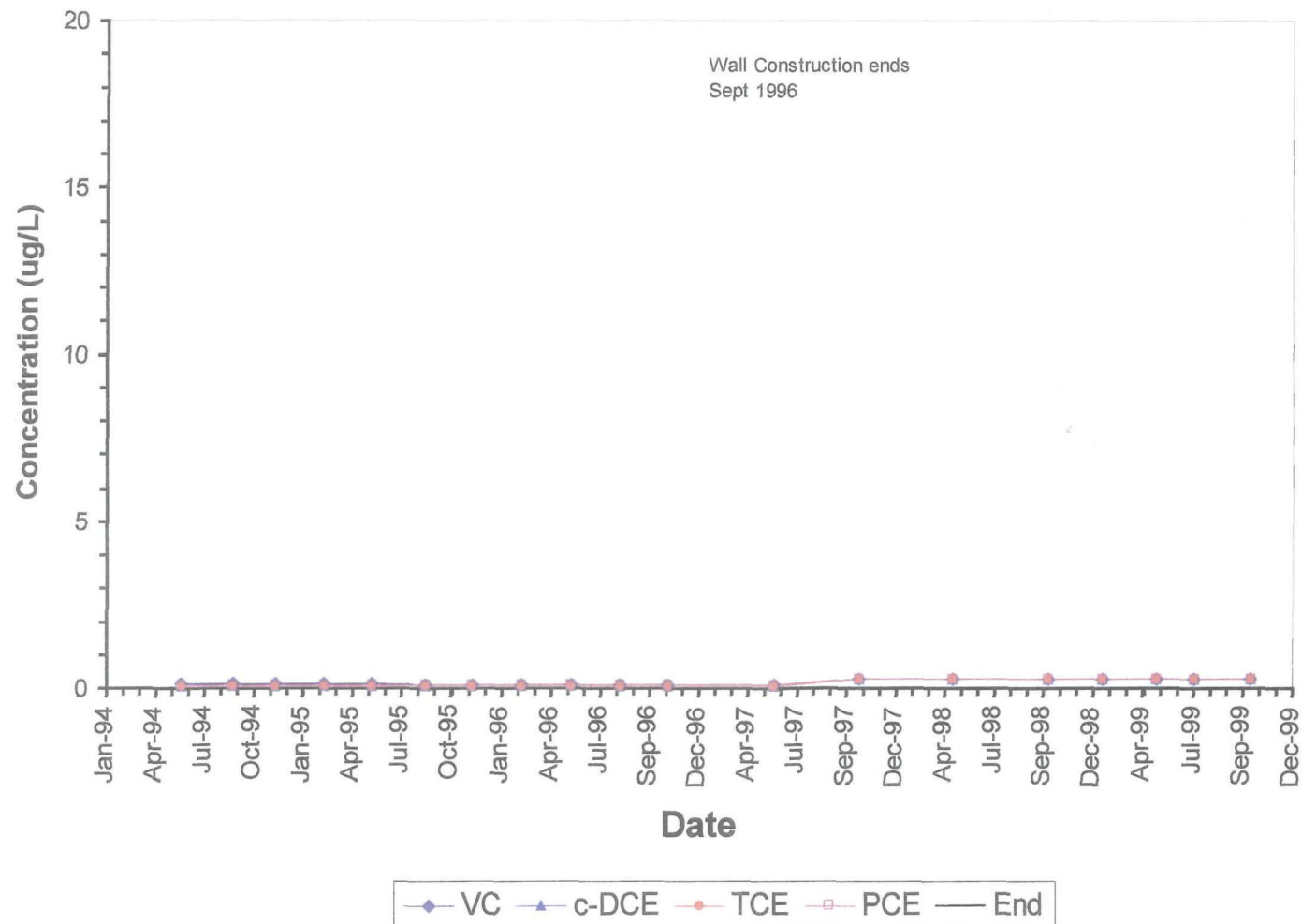
## H-2 Aquifer 2



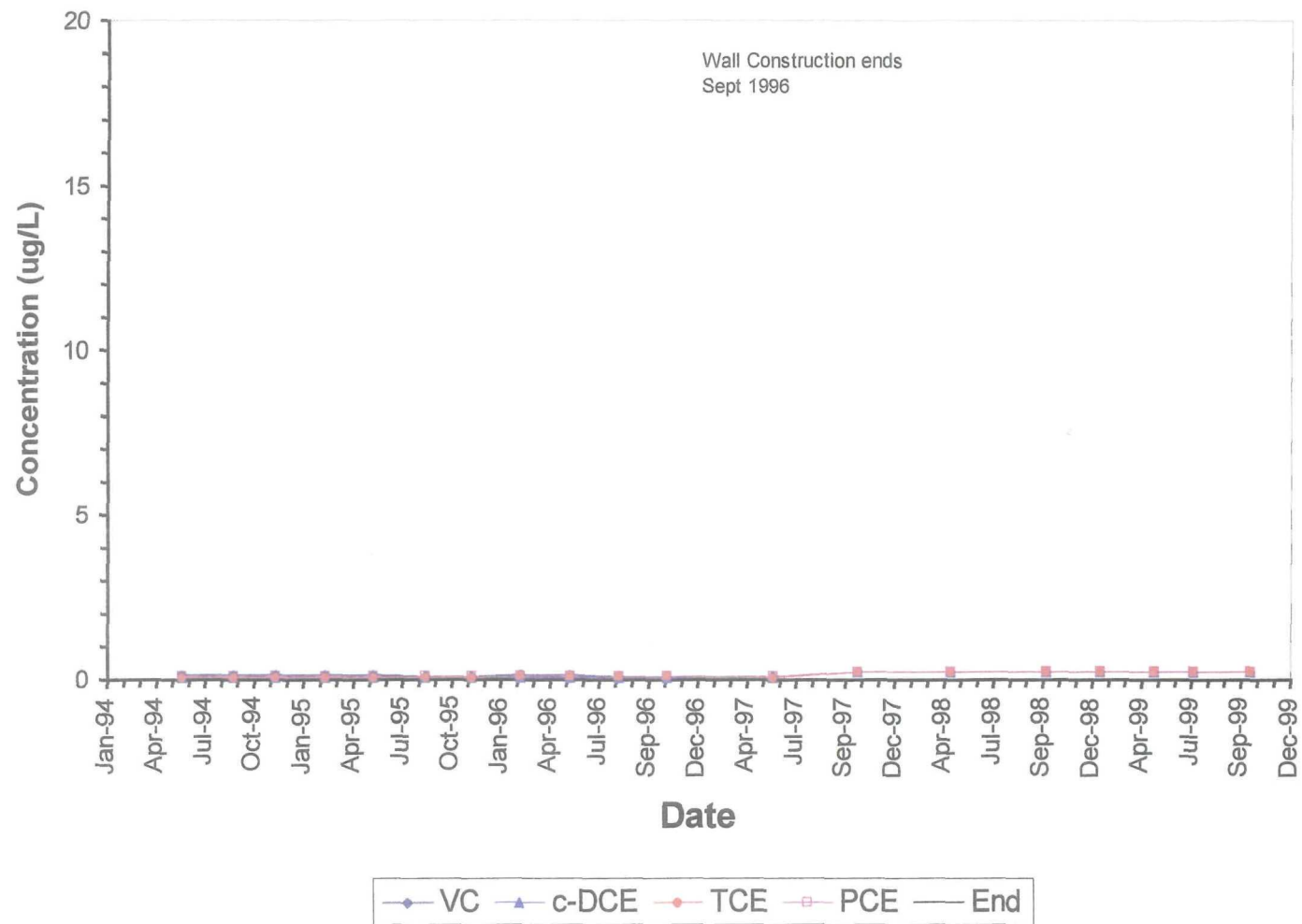
# I-2 Aquifer 2



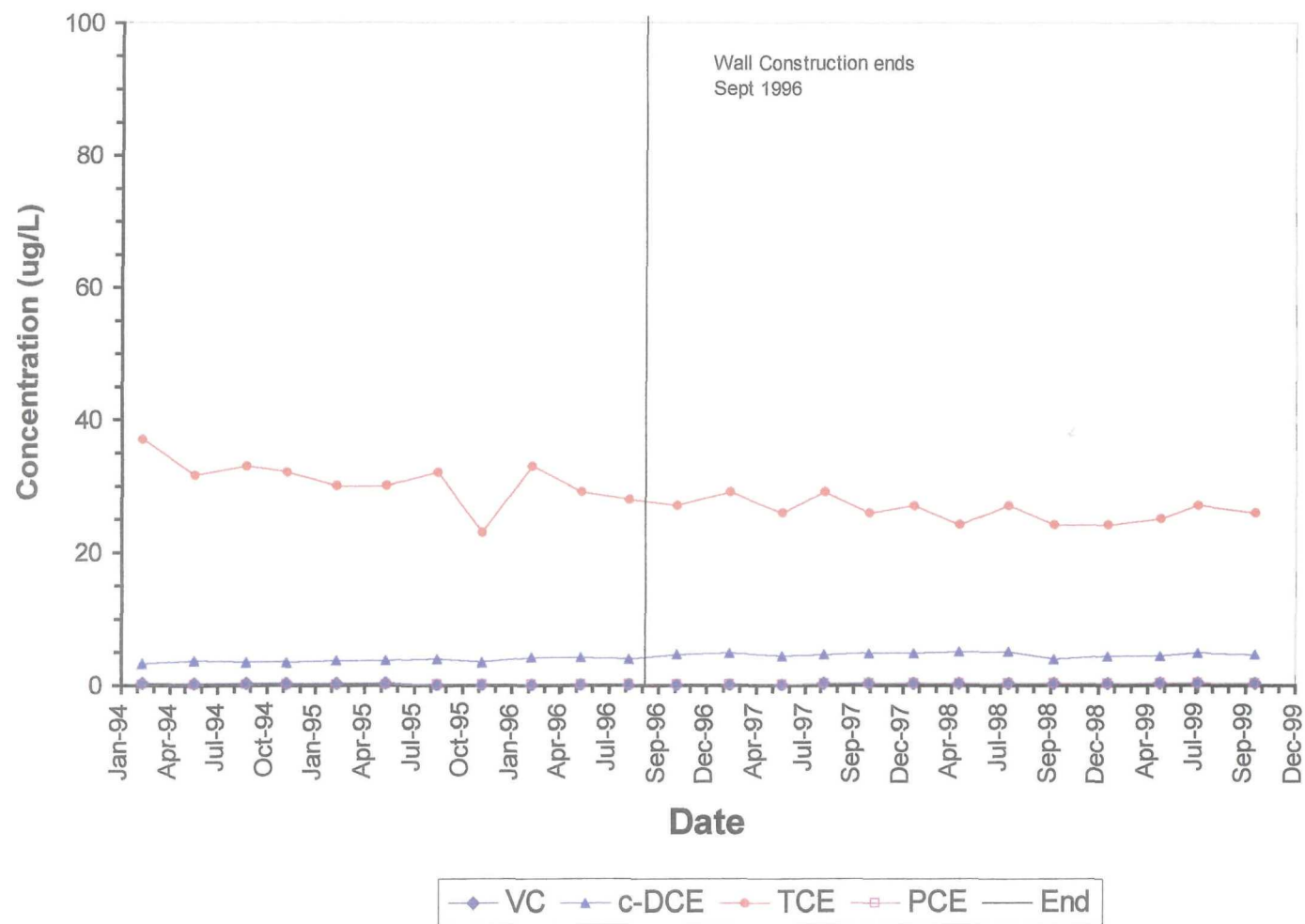
**J-2  
Aquifer 2**



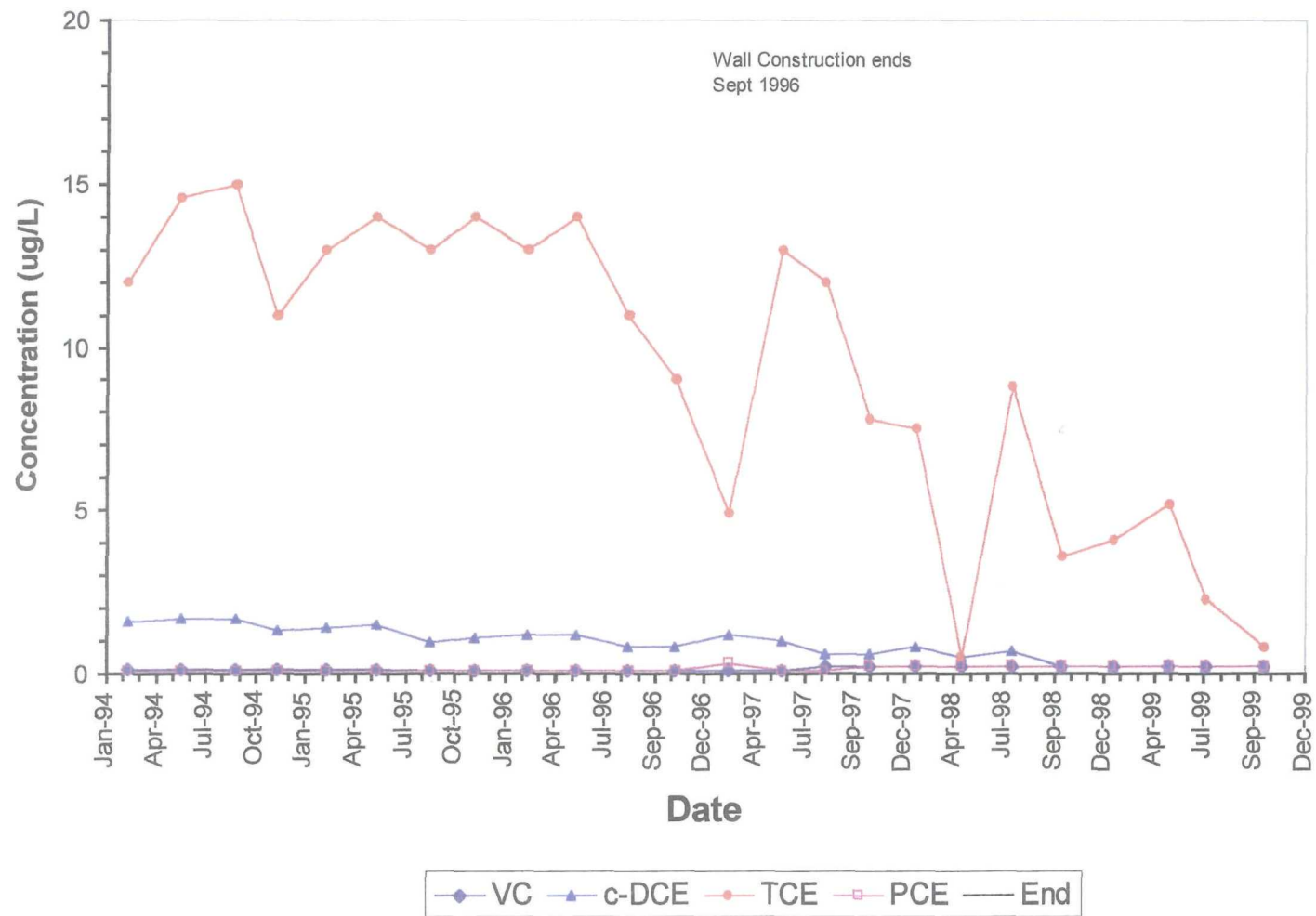
**K-2  
Aquifer 2**



**L-2  
Aquifer 2**

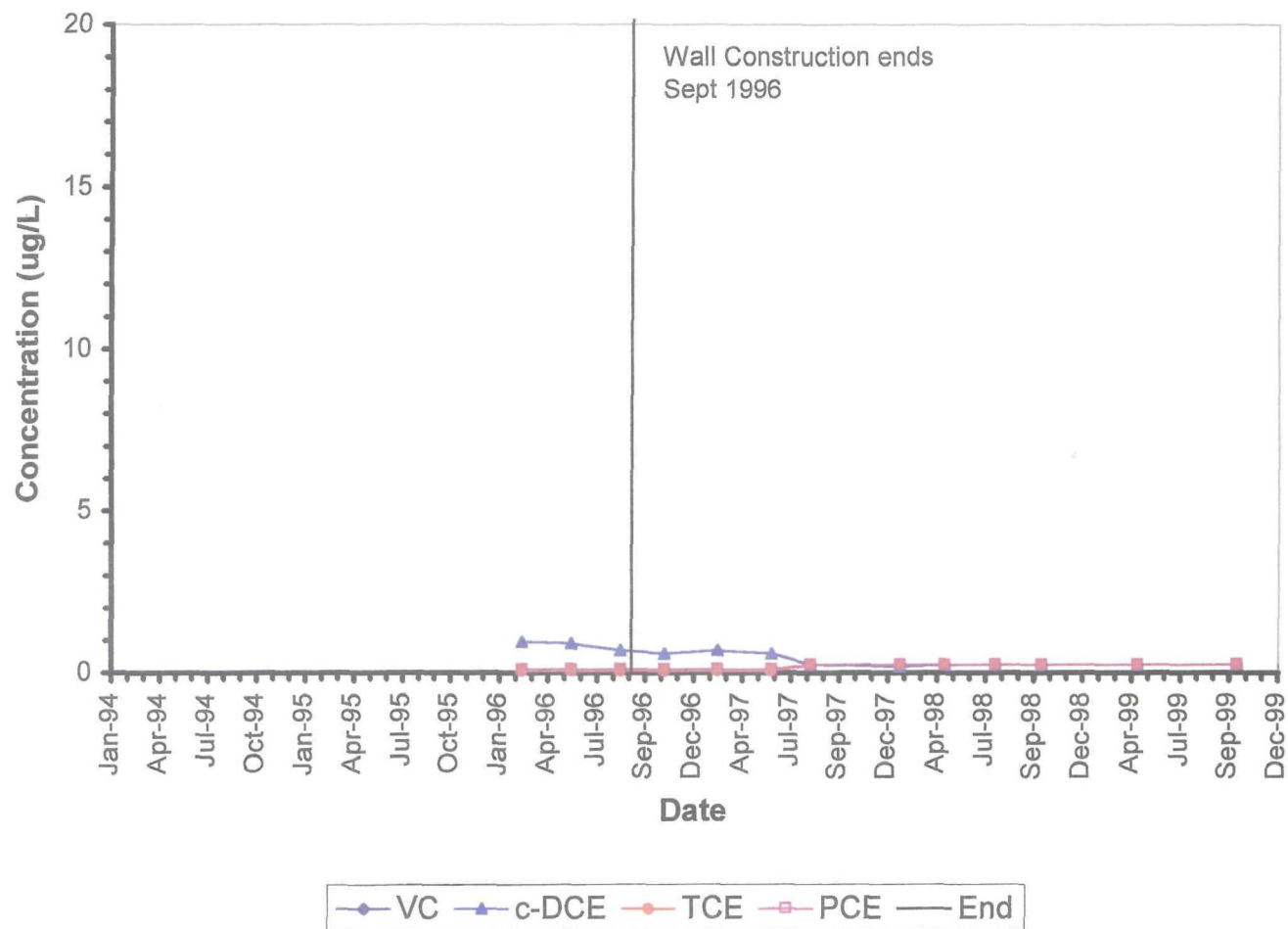


**M-2  
Aquifer 2**

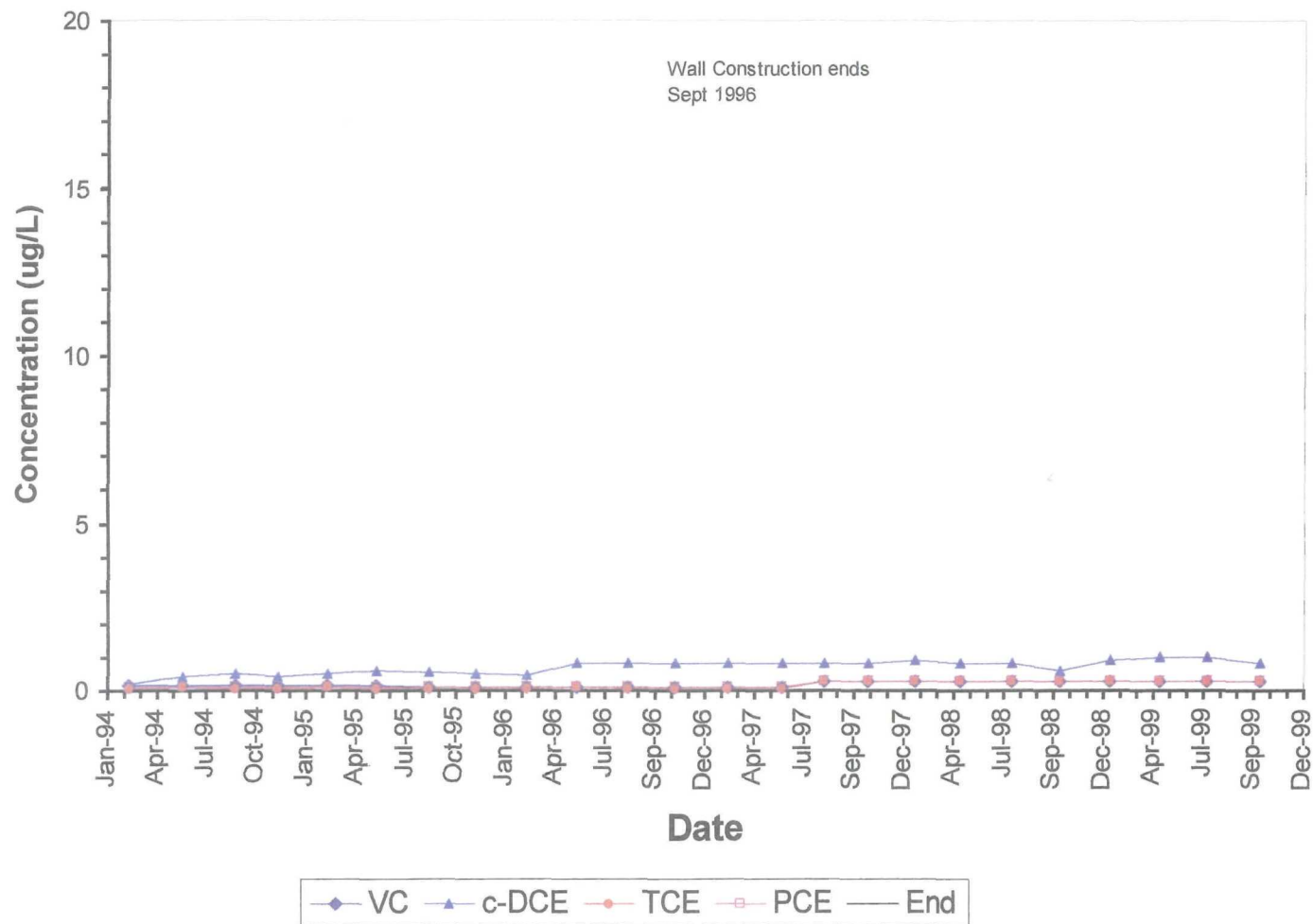




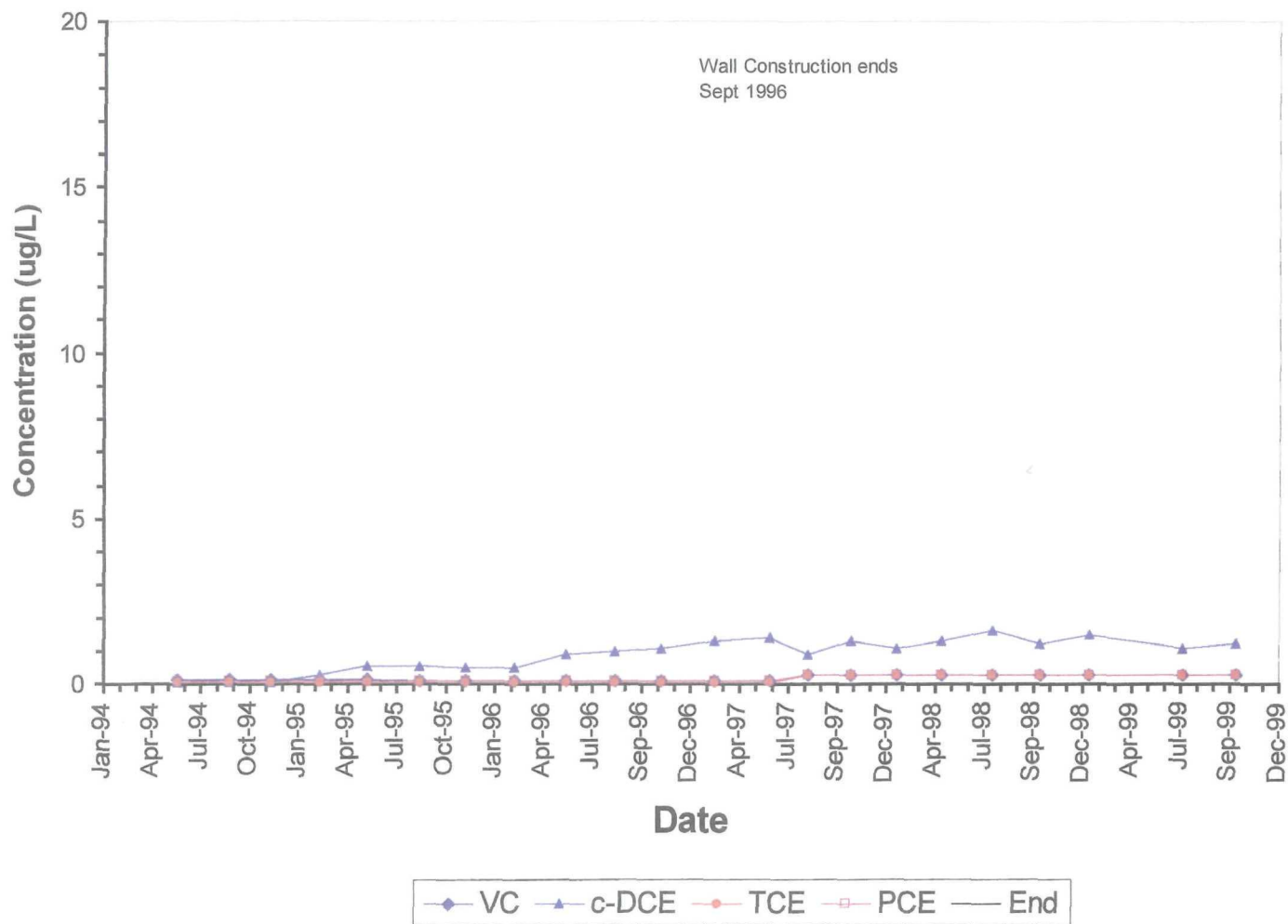
**MW-71  
Aquifer 2**



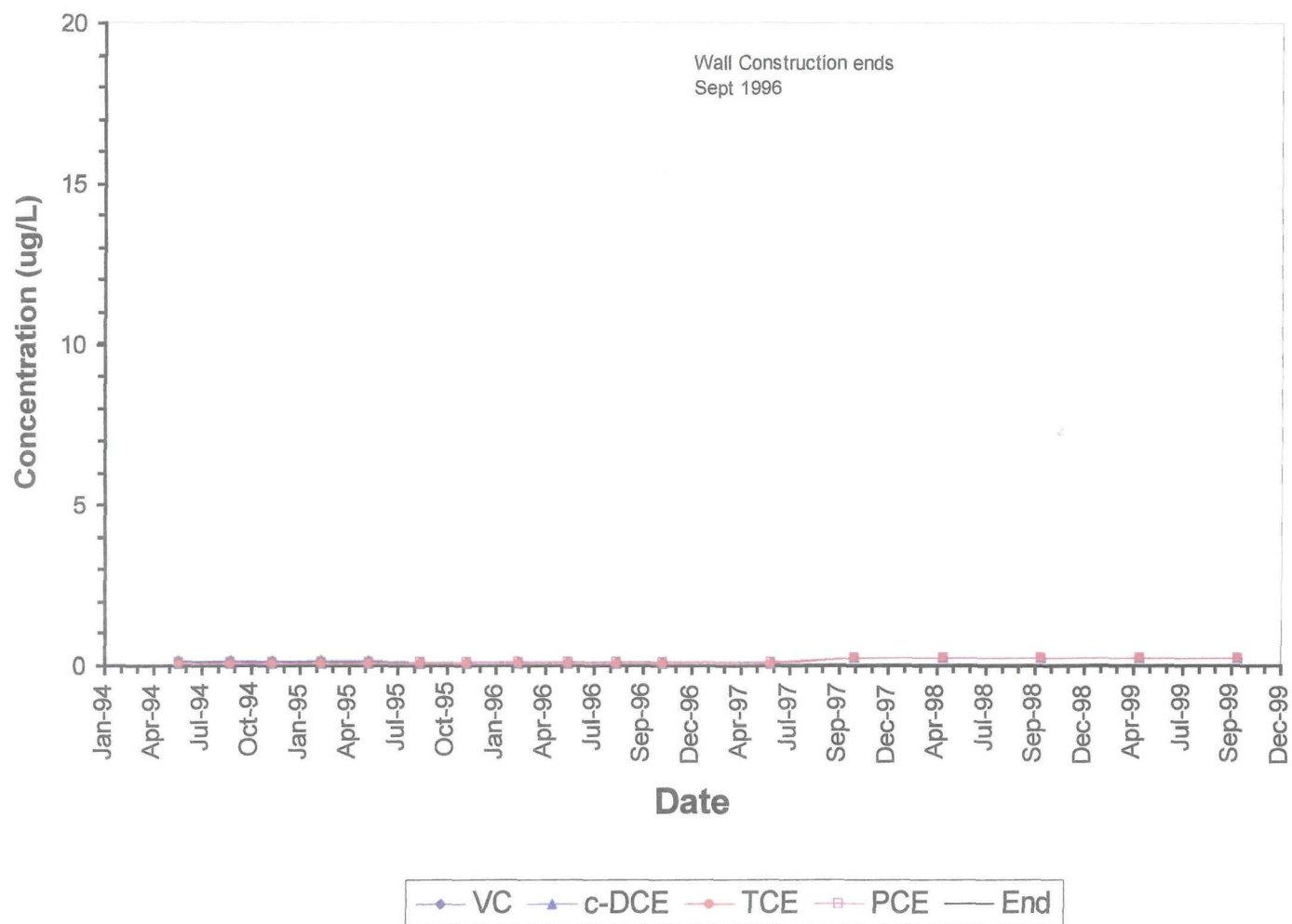
**N-2  
Aquifer 2**



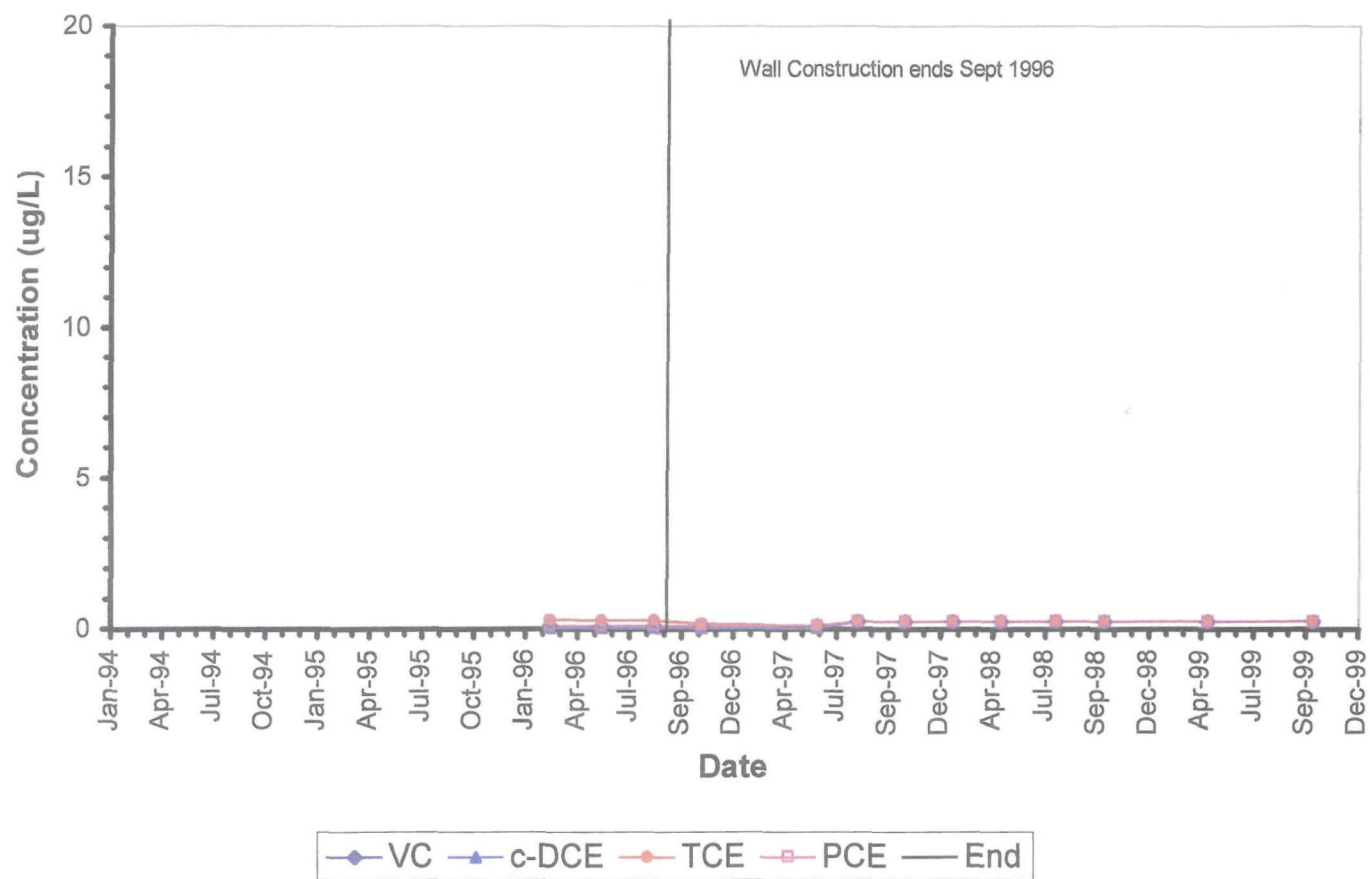
**O-2  
Aquifer 2**



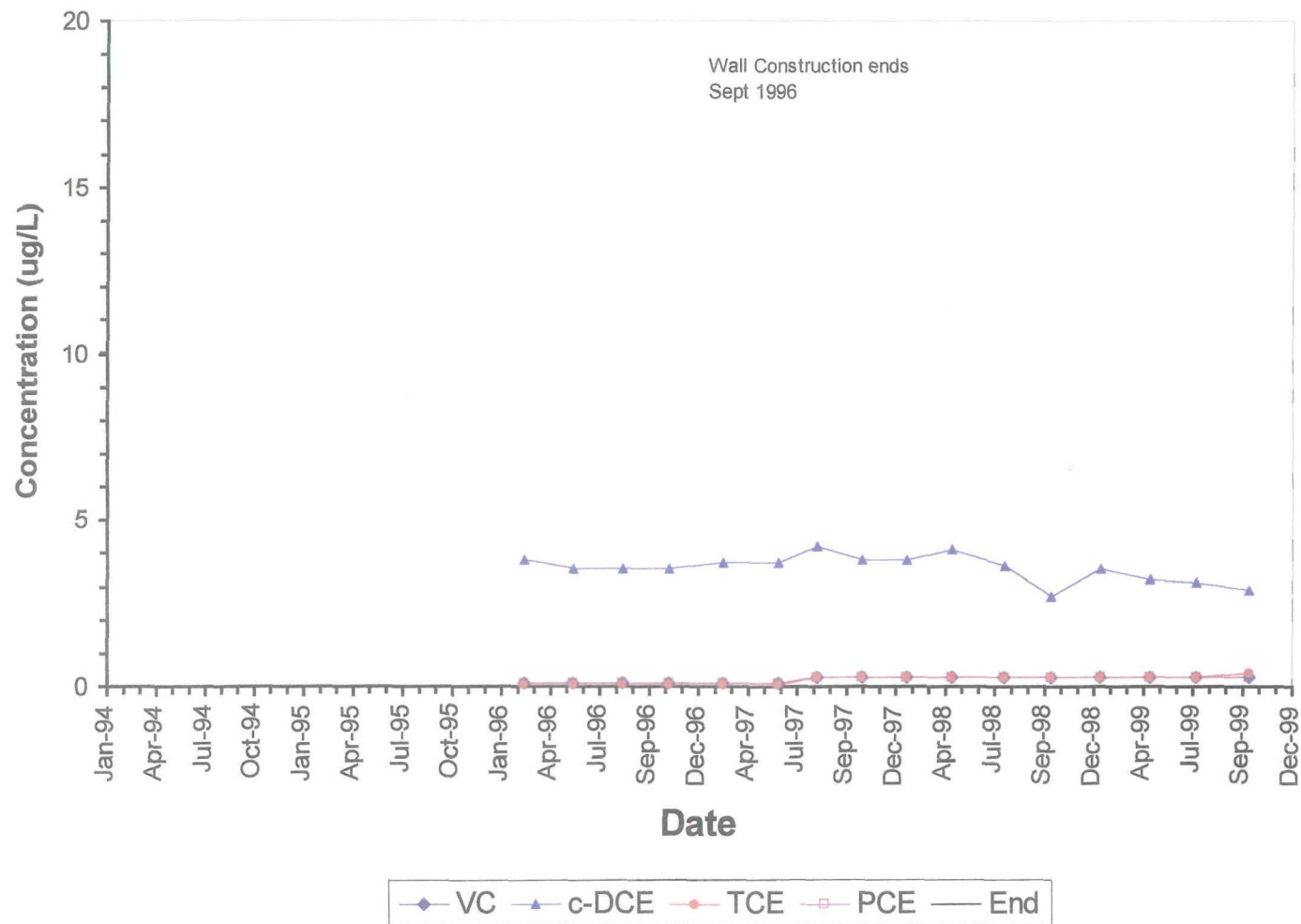
**P-2  
Aquifer 2**



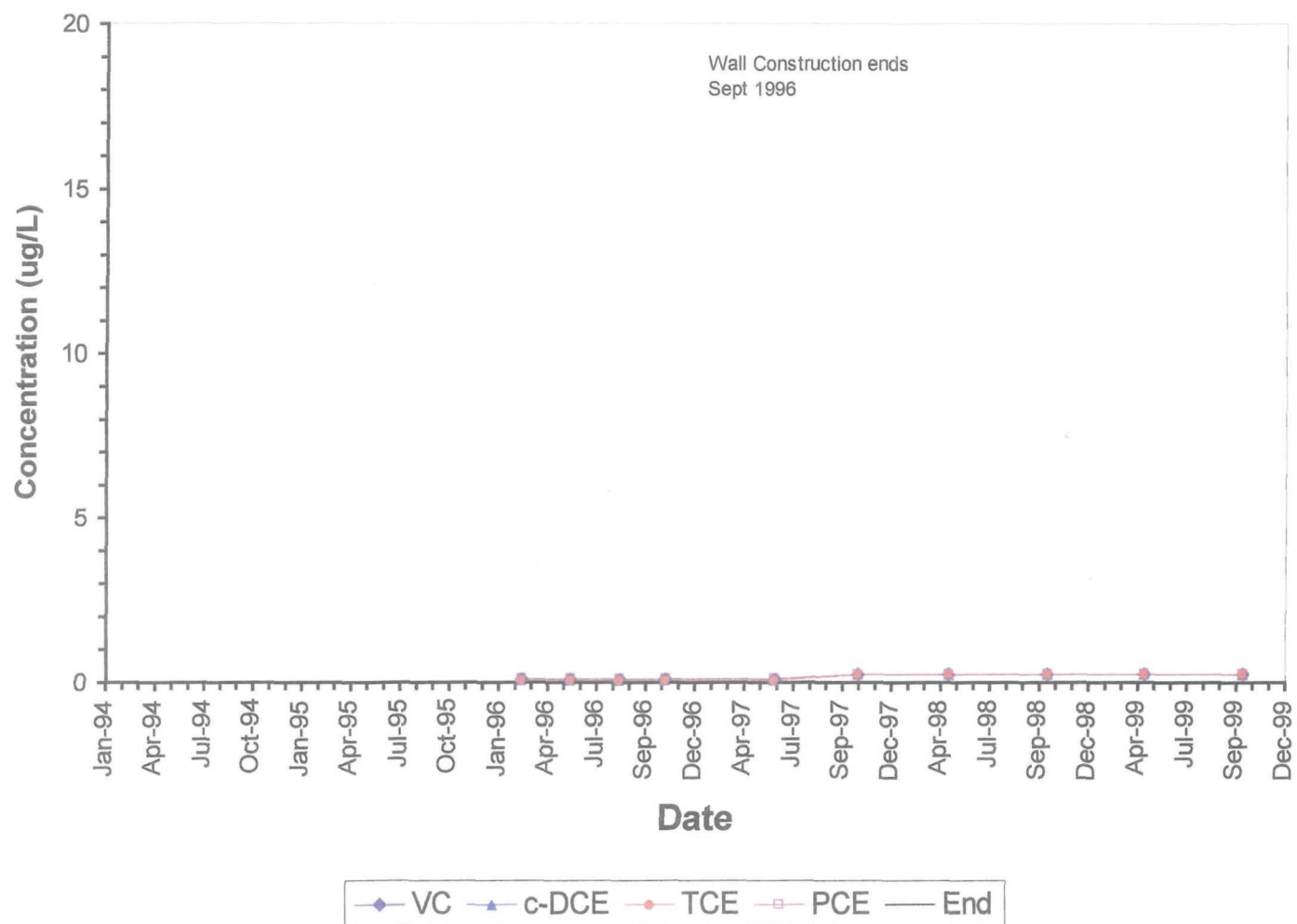
**R-2  
Aquifer 2**



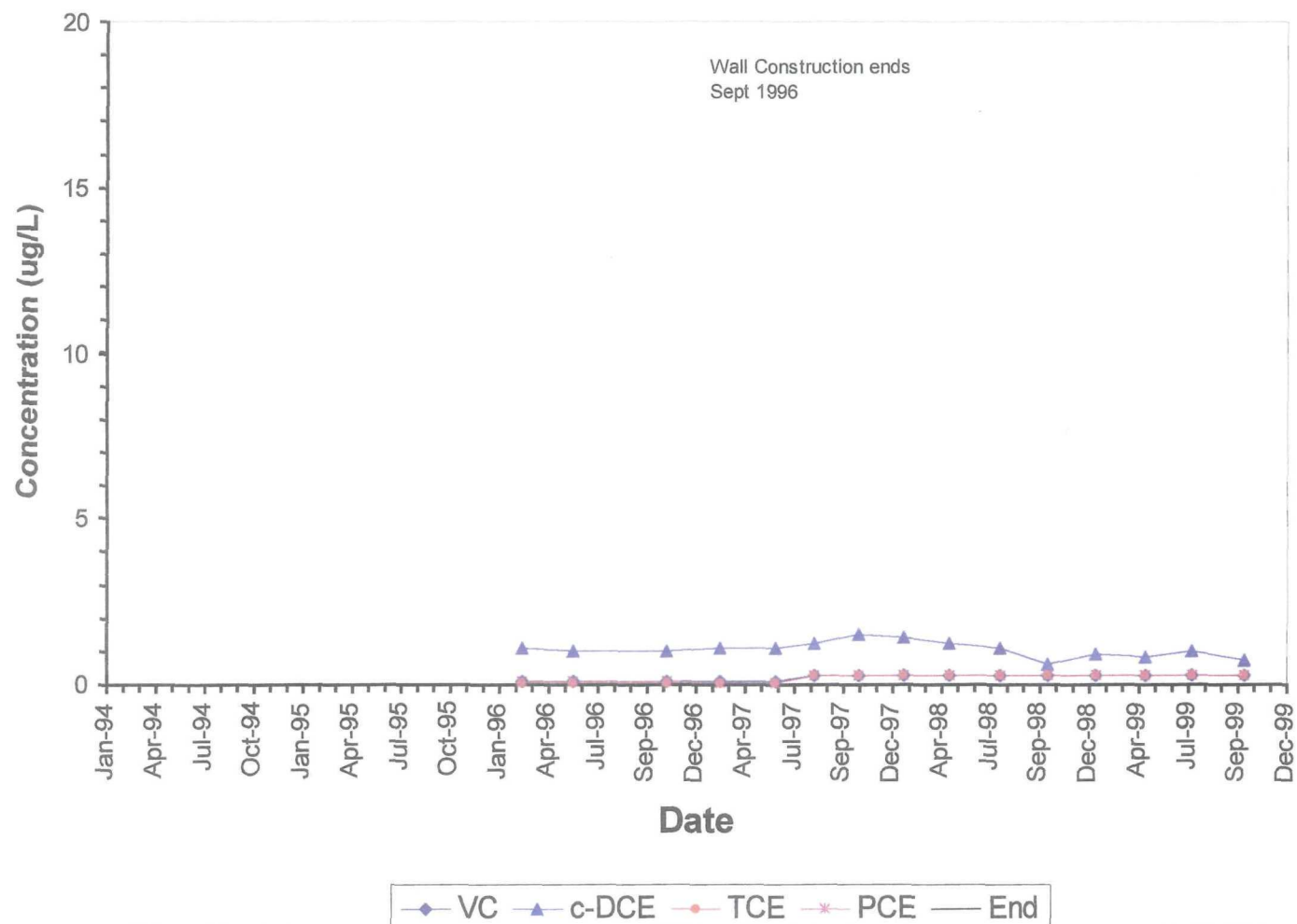
## S-2 Aquifer 2



**T-2  
Aquifer 2**



# U-2 Aquifer 2





APPENDIX E

MTCASat reports

# Compliance calculations

20 2/10/94 EC-2 Pre-construction cis-DCE  
 37.9 5/19/94  
 21 11/8/94  
 35 5/8/95  
 23 11/6/95  
 22 5/6/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	6	Mean	26.48
Censored	0	Lognormal mean	26.62
Detection limit or PQL	0.5	Std. devn.	7.838473491
Method detection limit	0.5	Median	22.5
TOTAL	6	Min.	20
		Max.	37.9
Lognormal distribution?			
r-squared is:		r-squared is:	
0.826		0.802	
Recommendations:			
Assume lognormal distribution.			
W value is 0.8067. This exceeds the tabled value of 0.788			
UCL (Land's method) is 34.95			

# Compliance calculations

5.6 11/11/96 EC-2 Post-construction cis-DCE  
 0.7 5/5/97  
 0.5 4/7/98

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	3	Mean	2.27
Censored	5	Lognormal mean	2.95
Detection limit or PQL	0.5	Std. devn.	2.888482877
Method detection limit	0.5	Median	0.7
TOTAL	8	Min.	0.5
		Max.	5.6
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
Unable to analyze probability plot for lognormal case.			
Unable to analyze probability plot for normal case.			
Consult Statistical Guidance document			
More than 50% of the data are censored.			
Use 5.6 (largest value) as UCL.			
See Statistical Guidance Supplement S-6 (Case 3)			

# Compliance calculations

1.7 11/11/96 EC-2 Post-construction TCE  
0.15 5/5/97

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	2	Mean	0.93
Censored	6	Lognormal mean	2.20
Detection limit or PQL	0.5	Std. devn.	1.096015511
Method detection limit	0.5	Median	0.925
TOTAL	8	Min.	0.15
		Max.	1.7
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations: Unable to analyze probability plots. Consult Statistical Guidance document			
More than 50% of the data are censored. Use 1.7 (largest value) as UCL. See Statistical Guidance Supplement S-6 (Case 3)			

# Compliance calculations

7 2/10/94 EC-2 Pre-construction TCE  
 5.9 5/19/94  
 3 11/8/94  
 3.6 5/8/95  
 9.5 11/6/95  
 5.7 5/6/96

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	6	Mean	5.78
Censored	0	Lognormal mean	5.89
Detection limit or PQL	0.5	Std. devn.	2.359166519
Method detection limit	0.5	Median	5.8
TOTAL	6	Min.	3
		Max.	9.5
Lognormal distribution?			
r-squared is:		Normal distribution?	
0.961		r-squared is:	
		0.955	
Recommendations:			
Assume lognormal distribution.			
W value is 0.9555. This exceeds the tabled value of 0.788			
UCL (Land's method) is 9.43			

# Compliance calculations

0.1 11/11/96 EC-2 Post-construction Vinyl Chloride  
0.1 5/5/97

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	2	Mean	0.10
Censored	6	Lognormal mean	0.10
Detection limit or PQL	0.5	Std. devn.	0
Method detection limit	0.5	Median	0.1
TOTAL	8	Min.	0.1
		Max.	0.1
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations: Can't analyze this data set.			
More than 50% of the data are censored. Use 0.1 (largest value) as UCL. See Statistical Guidance Supplement S-6 (Case 3)			

# Compliance calculations

5 2/10/94 EC-2 Pre-construction Vinyl Chloride  
 0.15 5/19/94  
 0.34 11/8/94  
 0.24 5/8/95  
 0.21 11/6/95  
 0.5 5/6/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	6	Mean	1.07
Censored	0	Lognormal mean	0.97
Detection limit or PQL	0.5	Std. devn.	1.927564958
Method detection limit	0.5	Median	0.29
TOTAL	6	Min.	0.15
		Max.	5
Lognormal distribution?			
r-squared is:		r-squared is:	
Recommendations:			
Assume lognormal distribution.			
W value is 0.7935. This exceeds the tabled value of 0.788			
UCL (Land's method) is 17.08			

# Compliance calculations

4.5 11/11/96 EC-2 Post-construction Chromium  
 2.5 5/5/97  
 7.3 10/20/97  
 3.2 4/7/98  
 2.9 10/5/98

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	5	Mean	4.08
Censored	4	Lognormal mean	4.13
Detection limit or PQL	4.8	Std. devn.	1.949871791
Method detection limit	4.8	Median	3.2
TOTAL	9	Min.	2.5
		Max.	7.3
Lognormal distribution?		Normal distribution?	
r-squared is:	0.957	r-squared is:	0.966
Recommendations:			
Use lognormal distribution.			
UCL (Land's method) is 8.64			
Cohen's method applied.			



# Compliance calculations

8 11/8/94 EC-2 Pre-construction Chromium  
 2.5 5/8/95  
 5 11/6/95  
 7.85 5/6/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	4	Mean	5.84
Censored	0	Lognormal mean	6.14
Detection limit or PQL	0.5	Std. devn.	2.618324846
Method detection limit	0.5	Median	6.425
TOTAL	4	Min.	2.5
		Max.	8
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations: Assume lognormal distribution. W value is 0.8585. This exceeds the tabled value of 0.748			
UCL (Land's method) is 21.01			

# Compliance calculations

0.3 5/5/97 SP-5 Post-construction cis-DCE  
0.2 10/20/97

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	2	Mean	0.25
Censored	7	Lognormal mean	0.26
Detection limit or PQL	0.5	Std. devn.	0.070710678
Method detection limit	0.5	Median	0.25
TOTAL	9	Min.	0.2
		Max.	0.3
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations:			
More than 50% of the data are censored. Use 0.3 (largest value) as UCL. See Statistical Guidance Supplement S-6 (Case 3)			

# Compliance calculations

0.425 2/5/96 SP-5 Pre-construction Vinyl Chloride  
0.5 5/7/96

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	2	Mean	0.46
Censored	0	Lognormal mean	0.46
Detection limit or PQL	0.5	Std. devn.	0.053033009
Method detection limit	0.5	Median	0.4625
TOTAL	2	Min.	0.425
		Max.	0.5
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations: Unable to analyze probability plots. Consult Statistical Guidance document			
UCL (Land's method) is N/A			

# Compliance calculations

244 11/11/96 SP-5 Post-construction Chromium  
 129 2/10/97  
 99.5 5/5/97  
 253 10/20/97  
 46 4/7/98  
 204 1/7/99  
 73.8 4/1/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	7	Mean	149.90
Censored	0	Lognormal mean	157.23
Detection limit or PQL	4.8	Std. devn.	83.64071975
Method detection limit	4.8	Median	129
TOTAL	7	Min.	46
		Max.	253
Lognormal distribution? Normal distribution?			
r-squared is: 0.945		r-squared is: 0.935	
Recommendations:			
Assume lognormal distribution.			
W value is 0.9267. This exceeds the tabled value of 0.803			
UCL (Land's method) is 327.8			

# Compliance calculations

117 2/5/96 SP-5 Pre-construction Chromium  
82.8 5/7/96

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	2	Mean	99.90
Censored	0	Lognormal mean	101.41
Detection limit or PQL	4.8	Std. devn.	24.18305192
Method detection limit	4.8	Median	99.9
TOTAL	2	Min.	82.8
		Max.	117
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations: Unable to analyze probability plots. Consult Statistical Guidance document			
UCL (Land's method) is N/A			

# Compliance calculations

8.1 11/11/96 SP-5 Post-construction TCE  
 2.5 2/10/97  
 2.9 5/5/97  
 2.6 10/20/97  
 1.3 4/7/98  
 2.6 1/7/99  
 1.7 4/1/99

MTCAS <i>at</i> 2.1			
Number of samples		Uncensored values	
Uncensored	7	Mean	3.10
Censored	2	Lognormal mean	3.10
Detection limit or PQL	0.5	Std. devn.	2.276693509
Method detection limit	0.5	Median	2.6
TOTAL	9	Min.	1.3
		Max.	8.1
Lognormal distribution?			
r-squared is:		Normal distribution?	
0.865		r-squared is:	
		0.718	
Recommendations:			
UCL (Land's method) is 10.31			
Cohen's method applied.			

# Compliance calculations

1.9 2/5/96 SP-5 Pre-construction TCE  
1.2 5/7/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	2	Mean	1.55
Censored	0	Lognormal mean	1.59
Detection limit or PQL	0.5	Std. devn.	0.494974747
Method detection limit	0.5	Median	1.55
TOTAL	2	Min.	1.2
		Max.	1.9
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations:			
UCL (Land's method) is N/A			

# Compliance calculations

146 11/8/94 Z-1 Pre-construction Chromium  
 28.5 2/7/95  
 18.8 11/6/95

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	3	Mean	64.43
Censored	5	Lognormal mean	76.92
Detection limit or PQL	15.7	Std. devn.	70.8051081
Method detection limit	15.7	Median	28.5
TOTAL	8	Min.	18.8
		Max.	146
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
Unable to analyze probability plot for lognormal case.			
Unable to analyze probability plot for normal case.			
Consult Statistical Guidance document			
More than 50% of the data are censored.			
Use 146 (largest value) as UCL.			
See Statistical Guidance Supplement S-6 (Case 3)			



# Compliance calculations

7.3 1/15/99 Z-1 1998-99 Chromium

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	1	Mean	7.30
Censored	4	Lognormal mean	N/A
Detection limit or PQL	5	Std. devn.	N/A
Method detection limit	5	Median	7.3
TOTAL	5	Min.	7.3
		Max.	7.3
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
Unable to analyze probability plots.			
Consult Statistical Guidance document			
More than 50% of the data are censored.			
Use 7.3 (largest value) as UCL.			
See Statistical Guidance Supplement S-6 (Case 3)			

# Compliance calculations

7.7 8/4/97 Z-1 Post-construction Chromium  
7.3 1/15/99

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	2	Mean	7.50
Censored	8	Lognormal mean	7.50
Detection limit or PQL	5	Std. devn.	0.282842712
Method detection limit	5	Median	7.5
TOTAL	10	Min.	7.3
		Max.	7.7
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations: Unable to analyze probability plots. Consult Statistical Guidance document			
More than 50% of the data are censored. Use 7.7 (largest value) as UCL. See Statistical Guidance Supplement S-6 (Case 3)			

# Compliance calculations

242 5/6/97 MW-6 Post-construction DCM  
 37 10/20/97  
 420 4/7/98  
 262 10/5/98

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	4	Mean	240.25
Censored	0	Lognormal mean	314.77
Detection limit or PQL	1	Std. devn.	157.1588899
Method detection limit	1	Median	252
TOTAL	4	Min.	37
		Max.	420
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is: 0.943	
Recommendations:			
Use normal distribution.			
UCL (based on t-statistic) is 425.15			

# Compliance calculations

9900 4/7/98  
61000 10/5/98

MW-6 1998-99 Chromium

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	2	Mean	35450.00
Censored	0	Lognormal mean	56164.99
Detection limit or PQL	0.5	Std. devn.	36133.15652
Method detection limit	0.5	Median	35450
TOTAL	2	Min.	9900
		Max.	61000
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations: Unable to analyze probability plots. Consult Statistical Guidance document			
UCL (based on t-statistic) is 196772.7			

# Compliance calculations

9550 5/6/97 MW-6 Post-construction Chromium  
 3200 10/20/97  
 9900 4/7/98  
 61000 10/5/98

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	4	Mean	20912.50
Censored	0	Lognormal mean	24578.46
Detection limit or PQL	10	Std. devn.	26901.80833
Method detection limit	10	Median	9725
TOTAL	4	Min.	3200
		Max.	61000
Lognormal distribution?		Normal distribution?	
r-squared is:	0.904	r-squared is:	
Recommendations:			
Use lognormal distribution.			
Unable to analyze probability plot for normal case.			
UCL (Land's method) is 7352471.48			

# Compliance calculations

84 4/7/98 MW-6 1998-99 Vinyl Chloride  
61 10/5/98

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	2	Mean	72.50
Censored	0	Lognormal mean	73.44
Detection limit or PQL	0.5	Std. devn.	16.26345597
Method detection limit	0.5	Median	72.5
TOTAL	2	Min.	61
		Max.	84
<div> <div>Lognormal distribution?</div> <div>Normal distribution?</div> </div> <div> <div>r-squared is:</div> <div>r-squared is:</div> </div> <div> <div>Recommendations:</div> <div>Unable to analyze probability plots.</div> <div>Consult Statistical Guidance document</div> </div>			
UCL (based on t-statistic) is 145.11			

# Compliance calculations

76 5/6/97 MW-6 Post-construction Vinyl Chloride  
 10 10/20/97  
 84 4/7/98  
 61 10/5/98

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	4	Mean	57.75
Censored	0	Lognormal mean	73.47
Detection limit or PQL	1	Std. devn.	33.2302573
Method detection limit	1	Median	68.5
TOTAL	4	Min.	10
		Max.	84
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
Reject lognormal distribution.			
W value is 0.7448. This is less than the tabled value of 0.748			
Assume normal distribution.			
W value is 0.8598. This exceeds the tabled value of 0.748			
UCL (based on t-statistic) is 96.85			

# Compliance calculations

1600 4/7/98 MW-6 1998-99 cis-DCE  
928 10/5/98

MTCAS <sub>tar</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	2	Mean	1264.00
Censored	0	Lognormal mean	1312.35
Detection limit or PQL	0.5	Std. devn.	475.175757
Method detection limit	0.5	Median	1264
TOTAL	2	Min.	928
		Max.	1600
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
Unable to analyze probability plots.			
Consult Statistical Guidance document			
UCL (based on t-statistic) is 3385.5			



# Compliance calculations

1340 5/6/97 MW-6 Post-construction cis-DCE  
 580 10/20/97  
 1600 4/7/98  
 928 10/5/98

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	4	Mean	1112.00
Censored	0	Lognormal mean	1146.17
Detection limit or PQL	0.5	Std. devn.	449.8177409
Method detection limit	0.5	Median	1134
TOTAL	4	Min.	580
		Max.	1600
Lognormal distribution?			
r-squared is:		0.960	
Normal distribution?			
r-squared is:		0.986	
Recommendations:			
Assume lognormal distribution.			
W value is 0.954. This exceeds the tabled value of 0.748			
UCL (Land's method) is 2772			

# Compliance calculations

860 4/7/98 MW-6 1998-99 TCE  
933 10/5/98

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	2	Mean	896.50
Censored	0	Lognormal mean	897.24
Detection limit or PQL	0.5	Std. devn.	51.61879503
Method detection limit	0.5	Median	896.5
TOTAL	2	Min.	860
		Max.	933
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations:			
UCL (based on t-statistic) is 1126.96			

# Compliance calculations

717 5/6/97 MW-6 Post-construction TCE  
 67 10/20/97  
 860 4/7/98  
 933 10/5/98

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	4	Mean	644.25
Censored	0	Lognormal mean	985.22
Detection limit or PQL	0.5	Std. devn.	395.1517641
Method detection limit	0.5	Median	788.5
TOTAL	4	Min.	67
		Max.	933
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
Reject lognormal distribution.			
W value is 0.7064. This is less than the tabled value of 0.748			
Assume normal distribution.			
W value is 0.8182. This exceeds the tabled value of 0.748			
UCL (based on t-statistic) is 1109.15			

# Compliance calculations

14 4/7/98 E1a 1998-99 Chromium  
 619 10/5/98  
 9.4 1/7/99  
 9.6 4/1/99  
 20.7 10/17/99

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	5	Mean	134.54
Censored	3	Lognormal mean	131.83
Detection limit or PQL	8.7	Std. devn.	270.8601816
Method detection limit	8.7	Median	14
TOTAL	8	Min.	9.4
		Max.	619
Lognormal distribution? r-squared is: 0.792			
Normal distribution? r-squared is:			
Recommendations:  Reject BOTH lognormal and normal distributions. See Statistics Guidance. Unable to analyze probability plot for normal case.			
UCL (Land's method) is 12675.15 Cohen's method applied.			

# Compliance calculations

12 11/11/96 E1a Post-construction Chromium  
 10.5 10/20/97  
 14 4/7/98  
 619 10/5/98  
 9.4 1/7/99  
 9.6 4/1/99  
 20.7 10/17/99

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	7	Mean	99.31
Censored	6	Lognormal mean	66.75
Detection limit or PQL	9	Std. devn.	229.1931386
Method detection limit	9	Median	12
TOTAL	13	Min.	9.4
		Max.	619
Lognormal distribution? r-squared is: 0.714			
Normal distribution? r-squared is:			
Recommendations:			
Reject BOTH lognormal and normal distributions. See Statistics Guidance. Unable to analyze probability plot for normal case.			
UCL (Land's method) is 347.67 Cohen's method applied.			

# Compliance calculations

6180 11/8/94 E1a Pre-construction Chromium  
 188 2/8/95  
 20.8 5/10/95  
 183 8/15/95  
 338 11/6/95  
 40.1 2/5/96  
 20.6 5/6/96  
 537 8/5/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	938.44
Censored	0	Lognormal mean	1057.30
Detection limit or PQL	9	Std. devn.	2125.390434
Method detection limit	9	Median	185.5
TOTAL	8	Min.	20.6
		Max.	6180
Lognormal distribution? Normal distribution?			
r-squared is: 0.920		r-squared is:	
Recommendations:			
Use lognormal distribution.			
Unable to analyze probability plot for normal case.			
UCL (Land's method) is 75501.47			

# Compliance calculations

1 10/17/99 E1a 1998-99 Vinyl Chloride

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	1	Mean	1.00
Censored	7	Lognormal mean	N/A
Detection limit or PQL	0.5	Std. devn.	N/A
Method detection limit	0.5	Median	1
TOTAL	8	Min.	1
		Max.	1
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
More than 50% of the data are censored. Use 1 (largest value) as UCL. See Statistical Guidance Supplement S-6 (Case 3)			

# Compliance calculations

1 10/17/99 E1a Post-construction Vinyl Chloride

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	1	Mean	1.00
Censored	12	Lognormal mean	N/A
Detection limit or PQL	0.5	Std. devn.	N/A
Method detection limit	0.5	Median	1
TOTAL	13	Min.	1
		Max.	1
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations:			
More than 50% of the data are censored. Use 1 (largest value) as UCL. See Statistical Guidance Supplement S-6 (Case 3)			



# Compliance calculations

3.1 11/8/94 E1a Pre-construction Vinyl Chloride  
 4 5/10/95  
 11 8/15/95  
 0.94 11/6/95

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	4	Mean	4.76
Censored	4	Lognormal mean	5.61
Detection limit or PQL	0.5	Std. devn.	4.353665123
Method detection limit	0.5	Median	3.55
TOTAL	8	Min.	0.94
		Max.	11
Lognormal distribution?		Normal distribution?	
r-squared is:	0.932	r-squared is:	0.929
Recommendations:			
Use lognormal distribution.			
UCL (Land's method) is 819.11			
Cohen's method applied.			

# Compliance calculations

2.7 7/20/98 E1a 1998-99 cis-DCE  
 4.8 10/5/98  
 0.5 7/4/99  
 5.4 10/17/99

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	4	Mean	3.35
Censored	4	Lognormal mean	4.44
Detection limit or PQL	0.5	Std. devn.	2.224859546
Method detection limit	0.5	Median	3.75
TOTAL	8	Min.	0.5
		Max.	5.4
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations: Unable to analyze probability plot for lognormal case.			
Unable to analyze probability plot for normal case. Consult Statistical Guidance document			
UCL (based on t-statistic) is 2.9 Cohen's method applied.			

# Compliance calculations

0.3 11/11/96 E1a Post-construction cis-DCE  
 1.1 8/4/97  
 0.2 10/20/97  
 2.7 7/20/98  
 4.8 10/5/98  
 0.5 7/4/99  
 5.4 10/17/99

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	7	Mean	2.14
Censored	6	Lognormal mean	2.75
Detection limit or PQL	0.5	Std. devn.	2.19610044
Method detection limit	0.5	Median	1.1
TOTAL	13	Min.	0.2
		Max.	5.4
Lognormal distribution?			
r-squared is:		Normal distribution?	
0.863		r-squared is:	
		0.659	
Recommendations:			
Reject BOTH lognormal and normal distributions. See Statistics Guidance.			
UCL (Land's method) is 9.83			
Cohen's method applied.			

# Compliance calculations

150 11/8/94 E1a Pre-construction cis-DCE  
 13 2/8/95  
 83 5/10/95  
 250 8/15/95  
 92 11/6/95  
 130 2/5/96  
 54 5/6/96  
 49 8/5/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	102.63
Censored	0	Lognormal mean	115.69
Detection limit or PQL	0.1	Std. devn.	74.14645257
Method detection limit	0.1	Median	87.5
TOTAL	8	Min.	13
		Max.	250
Lognormal distribution? Normal distribution?			
r-squared is: 0.926		r-squared is: 0.920	
Recommendations:			
Assume lognormal distribution.			
W value is 0.9401. This exceeds the tabled value of 0.818			
UCL (Land's method) is 339.98			

# Compliance calculations

0.8 10/5/98 E1a 1998-99 TCE

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	1	Mean	0.80
Censored	7	Lognormal mean	N/A
Detection limit or PQL	0.5	Std. devn.	N/A
Method detection limit	0.5	Median	0.8
TOTAL	8	Min.	0.8
		Max.	0.8
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations: Unable to analyze probability plots. Consult Statistical Guidance document			
More than 50% of the data are censored. Use 0.8 (largest value) as UCL. See Statistical Guidance Supplement S-6 (Case 3)			

# Compliance calculations

0.7 11/11/96 E1a Post-construction TCE  
 0.2 2/10/97  
 0.6 8/4/97  
 0.3 10/20/97  
 0.8 10/5/98

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	5	Mean	0.52
Censored	8	Lognormal mean	0.55
Detection limit or PQL	0.5	Std. devn.	0.258843582
Method detection limit	0.5	Median	0.6
TOTAL	13	Min.	0.2
		Max.	0.8
Lognormal distribution?			
r-squared is:	0.984	Normal distribution?	
		r-squared is:	0.993
Recommendations:			
More than 50% of the data are censored. Use 0.8 (largest value) as UCL. See Statistical Guidance Supplement S-6 (Case 3)			

# Compliance calculations

39 11/8/94 E1a Pre-construction TCE  
 4.7 2/8/95  
 7.4 5/10/95  
 29 8/15/95  
 35 11/6/95  
 19 2/5/96  
 13 5/6/96  
 10 8/5/96

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	19.64
Censored	0	Lognormal mean	20.89
Detection limit or PQL	0.5	Std. devn.	13.14098686
Method detection limit	0.5	Median	16
TOTAL	8	Min.	4.7
		Max.	39
Lognormal distribution?		Normal distribution?	
r-squared is:	0.964	r-squared is:	0.932
Recommendations:			
Assume lognormal distribution.			
W value is 0.9456. This exceeds the tabled value of 0.818			
UCL (Land's method) is 48.34			

# Compliance calculations

49 1/22/98 E1 1998-99 Chromium  
 40 4/7/98  
 18 10/5/98  
 46.3 1/7/99  
 28.7 4/1/99  
 16.3 7/1/99  
 15 10/7/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	7	Mean	30.47
Censored	1	Lognormal mean	31.17
Detection limit or PQL	18.6	Std. devn.	14.62597168
Method detection limit	18.6	Median	28.7
TOTAL	8	Min.	15
		Max.	49
Lognormal distribution?			
r-squared is:	0.934	Normal distribution?	
		r-squared is:	0.921
Recommendations:			
Use lognormal distribution.			
UCL (Land's method) is 45.51			
Simple substitution used with censored values.			



# Compliance calculations

118 11/11/96 E1 Post-construction Chromium  
 29.1 2/10/97  
 31.1 5/5/97  
 18.9 8/4/97  
 46.9 10/20/97  
 49 1/22/98  
 40 4/7/98  
 18 10/5/98  
 46.3 1/7/99  
 28.7 4/1/99  
 16.3 7/1/99  
 15 10/7/99

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	12	Mean	38.11
Censored	1	Lognormal mean	37.97
Detection limit or PQL	18.6	Std. devn.	28.04374694
Method detection limit	18.6	Median	30.1
TOTAL	13	Min.	15
		Max.	118
Lognormal distribution? r-squared is: 0.911			
Normal distribution? r-squared is: 0.683			
Recommendations: Use lognormal distribution.			
UCL (Land's method) is 52.9 Simple substitution used with censored values.			

# Compliance calculations

## E1 Pre-construction Chromium

30 8/23/94  
27.8 11/8/94  
20.6 2/8/95  
19.1 5/10/95  
226.3 8/15/95  
31.6 11/6/95  
17.2 5/6/96  
367 8/5/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	92.45
Censored	1	Lognormal mean	89.21
Detection limit or PQL	15.7	Std. devn.	131.6277652
Method detection limit	15.7	Median	28.9
TOTAL	9	Min.	17.2
		Max.	367
Lognormal distribution? r-squared is: 0.804			
Normal distribution? r-squared is: 0.693			
Recommendations:			
UCL (Land's method) is 339.73 Simple substitution used with censored values.			

# Compliance calculations

0.3 1/22/98 E1 1998-99 Vinyl Chloride  
 0.8 7/20/98  
 2 10/5/98  
 1.4 10/7/99

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	4	Mean	1.13
Censored	4	Lognormal mean	1.27
Detection limit or PQL	0.5	Std. devn.	0.736545993
Method detection limit	0.5	Median	1.1
TOTAL	8	Min.	0.3
		Max.	2
Lognormal distribution?		Normal distribution?	
r-squared is:	0.969	r-squared is:	
Recommendations:			
Use lognormal distribution.			
Unable to analyze probability plot for normal case.			
UCL (Land's method) is 3.18			
Cohen's method applied.			

# Compliance calculations

1.2 11/11/96 E1 Post-construction Vinyl Chloride  
 0.2 2/10/97  
 1 8/4/97  
 0.6 10/20/97  
 0.3 1/22/98  
 0.8 7/20/98  
 2 10/5/98  
 1.4 10/7/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	0.94
Censored	5	Lognormal mean	1.02
Detection limit or PQL	0.5	Std. devn.	0.597464882
Method detection limit	0.5	Median	0.9
TOTAL	13	Min.	0.2
		Max.	2
Lognormal distribution?		Normal distribution?	
r-squared is:	0.901	r-squared is:	0.926
Recommendations:			
Use lognormal distribution.			
UCL (Land's method) is 1.42			
Cohen's method applied.			

# Compliance calculations

10 5/1/90 E1 Pre-construction Vinyl Chloride  
 10 8/1/90  
 1 12/1/90  
 10 3/1/91  
 10 6/1/91  
 3 8/1/91  
 19 10/1/91  
 10 2/1/92  
 4 5/17/94  
 12 8/23/94  
 7.1 11/8/94  
 2.7 5/10/95  
 11 8/15/95  
 0.86 11/6/95

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	14	Mean	7.90
Censored	4	Lognormal mean	9.13
Detection limit or PQL	1	Std. devn.	5.082029749
Method detection limit	1	Median	10
TOTAL	18	Min.	0.86
		Max.	19
Lognormal distribution? r-squared is: 0.814			
Normal distribution? r-squared is: 0.821			
Recommendations:			
UCL (based on t-statistic) is 8.18 Cohen's method applied.			

# Compliance calculations

1 1/22/98 E1 1998-99 cis-DCE  
 2 4/7/98  
 1.7 7/20/98  
 3.5 10/5/98  
 0.25 1/7/99  
 0.8 4/1/99  
 1.2 7/1/99  
 2.9 10/7/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	1.67
Censored	1	Lognormal mean	1.85
Detection limit or PQL	0.5	Std. devn.	1.096402396
Method detection limit	0.5	Median	1.45
TOTAL	9	Min.	0.25
		Max.	3.5
Lognormal distribution? Normal distribution?			
r-squared is: 0.970		r-squared is: 0.933	
Recommendations:			
Use lognormal distribution.			
UCL (Land's method) is 4			
Simple substitution used with censored values.			

# Compliance calculations

4.7 11/11/96 E1 Post-construction cis-DCE  
 1.7 2/10/97  
 0.9 5/5/97  
 2.8 8/4/97  
 1.7 10/20/97  
 1 1/22/98  
 2 4/7/98  
 1.7 7/20/98  
 3.5 10/5/98  
 0.25 1/7/99  
 0.8 4/1/99  
 1.2 7/1/99  
 2.9 10/7/99

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	13	Mean	1.93
Censored	1	Lognormal mean	2.07
Detection limit or PQL	0.5	Std. devn.	1.243547448
Method detection limit	0.5	Median	1.7
TOTAL	14	Min.	0.25
		Max.	4.7
Lognormal distribution? r-squared is: 0.958			
Normal distribution? r-squared is: 0.920			
Recommendations:			
UCL (Land's method) is 3.37 Simple substitution used with censored values.			

# Compliance calculations

## E1 Pre-construction cis-DCE

2 2/1/90  
 3 5/1/90  
 52 8/1/90  
 8 12/1/90  
 78 3/1/91  
 27 6/1/91  
 190 8/1/91  
 160 10/1/91  
 50 2/1/92  
 44.3 5/17/94  
 220 8/23/94  
 150 11/8/94  
 8.9 2/8/95  
 56 5/10/95  
 270 8/15/95  
 73 11/6/95  
 46 2/5/96  
 16 5/6/96  
 43 8/5/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	19	Mean	78.80
Censored	0	Lognormal mean	108.05
Detection limit or PQL	0.5	Std. devn.	79.70164504
Method detection limit	0.5	Median	50
TOTAL	19	Min.	2
		Max.	270

Lognormal distribution?	Normal distribution?
r-squared is: 0.936	r-squared is: 0.840

Recommendations:  
Assume lognormal distribution.  
W value is 0.929. This exceeds the tabled value of 0.901

UCL (Land's method) is 313.07



# Compliance calculations

0.5 11/11/96 E1 Post-construction TCE  
0.2 2/10/97

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	2	Mean	0.35
Censored	11	Lognormal mean	0.39
Detection limit or PQL	0.5	Std. devn.	0.212132034
Method detection limit	0.5	Median	0.35
TOTAL	13	Min.	0.2
		Max.	0.5
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
Unable to analyze probability plots.			
Consult Statistical Guidance document			
More than 50% of the data are censored.			
Use 0.5 (largest value) as UCL.			
See Statistical Guidance Supplement S-6 (Case 3)			

# Compliance calculations

5 2/1/90 E1 Pre-construction TCE  
 1 5/1/90  
 5 8/1/90  
 5 12/1/90  
 3 3/1/91  
 5 6/1/91  
 5 8/1/91  
 1 10/1/91  
 10 2/1/92  
 3.5 5/17/94  
 20 8/23/94  
 23 11/8/94  
 3.2 2/8/95  
 5.1 5/10/95  
 24 8/15/95  
 30 11/6/95  
 8.1 2/5/96  
 2.8 5/6/96  
 7.2 8/5/96

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	19	Mean	8.78
Censored	0	Lognormal mean	9.12
Detection limit or PQL	0.5	Std. devn.	8.656100171
Method detection limit	0.5	Median	5
TOTAL	19	Min.	1
		Max.	30
Lognormal distribution?			
r-squared is:		r-squared is:	
0.938		0.759	
Recommendations:			
Assume lognormal distribution.			
W value is 0.9328. This exceeds the tabled value of 0.901			
UCL (Land's method) is 16.21			

# Compliance calculations

46.7 11/11/96 B1 Post-construction Chromium  
 45.8 2/10/97  
 67 5/6/97

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	3	Mean	53.17
Censored	0	Lognormal mean	53.54
Detection limit or PQL	0.5	Std. devn.	11.98846668
Method detection limit	0.5	Median	46.7
TOTAL	3	Min.	45.8
		Max.	67
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
Assume lognormal distribution.			
W value is 0.7887. This exceeds the tabled value of 0.767			
UCL (Land's method) is 89.77			

# Compliance calculations

73.3 11/8/94  
124 2/7/95  
65.3 5/10/95  
66.8 8/15/95  
86.3 11/6/95  
114 2/5/96  
63 5/6/96  
68.9 8/5/96

## B1 Pre-construction Chromium

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	82.70
Censored	0	Lognormal mean	82.91
Detection limit or PQL	0.5	Std. devn.	23.66673374
Method detection limit	0.5	Median	71.1
TOTAL	8	Min.	63
		Max.	124
Lognormal distribution? r-squared is: 0.847			
Normal distribution? r-squared is: 0.812			
Recommendations: Assume lognormal distribution. W value is 0.831. This exceeds the tabled value of 0.818			
UCL (Land's method) is 101.3			

# Compliance calculations

24 11/11/96 B1 Post-construction cis-DCE  
 39 2/10/97  
 52 5/6/97

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	3	Mean	38.33
Censored	0	Lognormal mean	39.41
Detection limit or PQL	0.5	Std. devn.	14.0118997
Method detection limit	0.5	Median	39
TOTAL	3	Min.	24
		Max.	52
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is: 0.998	
Recommendations:			
Use lognormal distribution.			
UCL (based on t-statistic) is 61.96			

# Compliance calculations

24 11/11/96 B1 Post-construction cis-DCE  
 39 2/10/97  
 52 5/6/97

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	3	Mean	38.33
Censored	0	Lognormal mean	39.41
Detection limit or PQL	0.5	Std. devn.	14.0118997
Method detection limit	0.5	Median	39
TOTAL	3	Min.	24
		Max.	52
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is: 0.998	
Recommendations:			
Assume lognormal distribution.			
W value is 0.9786. This exceeds the tabled value of 0.767			
UCL (Land's method) is 162.09			

# Compliance calculations

73 2/1/90 B1 Pre-construction cis-DCE  
 45 5/1/90  
 29 8/1/90  
 32 12/1/90  
 23 3/1/91  
 41 6/1/91  
 38 8/1/91  
 38 2/1/92  
 54.5 5/17/94  
 28 8/23/94  
 4.4 11/8/94  
 53 2/7/95  
 24 5/10/95  
 11 8/15/95  
 13 11/6/95  
 27 2/5/96  
 27 5/6/96  
 49 8/5/96

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	18	Mean	33.88
Censored	0	Lognormal mean	35.96
Detection limit or PQL	0.5	Std. devn.	17.07968349
Method detection limit	0.5	Median	30.5
TOTAL	18	Min.	4.4
		Max.	73
Lognormal distribution?			
r-squared is:		r-squared is:	
0.877		0.974	
Recommendations:			
Reject lognormal distribution.			
W value is 0.89. This is less than the tabled value of 0.897			
Assume normal distribution.			
W value is 0.9775. This exceeds the tabled value of 0.897			
UCL (based on t-statistic) is 40.89			

# Compliance calculations

7.6 11/11/96 B1 Post-construction Vinyl Chloride  
 8.4 2/10/97  
 5.5 5/6/97

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	3	Mean	7.17
Censored	0	Lognormal mean	7.23
Detection limit or PQL	1	Std. devn.	1.497776129
Method detection limit	1	Median	7.6
TOTAL	3	Min.	5.5
		Max.	8.4
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations: Assume lognormal distribution. W value is 0.9155. This exceeds the tabled value of 0.767			
UCL (Land's method) is 12.44			



# Compliance calculations

10 2/1/90  
 10 5/1/90  
 10 8/1/90  
 10 12/1/90  
 10 3/1/91  
 2 6/1/91  
 9 8/1/91  
 10 2/1/92  
 3.2 5/17/94  
 8.2 8/23/94  
 0.8 11/8/94  
 0.5 2/7/95  
 3.2 5/10/95  
 6.7 8/15/95  
 2 11/6/95  
 0.425 2/5/96  
 2.5 5/6/96  
 0.5 8/5/96

## B1 Pre-construction Vinyl Chloride

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	18	Mean	5.50
Censored	2	Lognormal mean	6.86
Detection limit or PQL	1	Std. devn.	4.090200558
Method detection limit	1	Median	4.95
TOTAL	20	Min.	0.425
		Max.	10
Lognormal distribution?			
r-squared is:		r-squared is:	
0.875		0.819	
Recommendations:			
Reject BOTH lognormal and normal distributions. See Statistics Guidance.			
UCL (Land's method) is 13.14			
Simple substitution used with censored values.			

# Compliance calculations

13 11/11/96 B1 Post-construction TCE  
 8.5 2/10/97  
 13 5/6/97

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	3	Mean	11.50
Censored	0	Lognormal mean	11.63
Detection limit or PQL	0.5	Std. devn.	2.598076211
Method detection limit	0.5	Median	13
TOTAL	3	Min.	8.5
		Max.	13
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations: Reject lognormal distribution. W value is 0.7503. This is less than the tabled value of 0.767 Reject normal distribution. W value is 0.75. This is less than the tabled value of 0.767			
UCL (Land's method) is 21.95			

# Compliance calculations

23 2/1/90 B1 Pre-construction TCE

23 5/1/90

29 8/1/90

26 12/1/90

22 3/1/91

28 6/1/91

16 8/1/91

23 2/1/92

14 5/17/94

12 8/23/94

9.4 11/8/94

37 2/7/95

20 5/10/95

10 8/15/95

19 11/6/95

49 2/5/96

26 5/6/96

30 8/5/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	18	Mean	23.13
Censored	0	Lognormal mean	23.35
Detection limit or PQL	0.5	Std. devn.	9.793875637
Method detection limit	0.5	Median	23
TOTAL	18	Min.	9.4
		Max.	49
Lognormal distribution? Normal distribution?			
r-squared is:	0.965	r-squared is:	0.929
Recommendations:			
Assume lognormal distribution.			
W value is 0.964. This exceeds the tabled value of 0.897			
UCL (Land's method) is 28.73			

# Compliance calculations

42 2/6/96 C2a Pre-construction TCE  
 37 5/7/96  
 40 8/6/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	3	Mean	39.67
Censored	0	Lognormal mean	39.69
Detection limit or PQL	0.5	Std. devn.	2.516611478
Method detection limit	0.5	Median	40
TOTAL	3	Min.	37
		Max.	42
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations: Assume lognormal distribution. W value is 0.9786. This exceeds the tabled value of 0.767			
UCL (Land's method) is 44.55			

# Compliance calculations

35 11/12/96 C2a Post-construction TCE

38 2/11/97

33 5/19/97

32 8/4/97

28 10/21/97

30 1/19/98

27 4/6/98

31 7/14/98

26 10/6/98

27 1/4/99

26 4/25/99

25 7/1/99

27 10/17/99

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	13	Mean	29.62
Censored	0	Lognormal mean	29.63
Detection limit or PQL	0.5	Std. devn.	3.969434501
Method detection limit	0.5	Median	28
TOTAL	13	Min.	25
		Max.	38
Lognormal distribution?			
r-squared is:	0.933	Normal distribution?	
		r-squared is:	0.914
Recommendations:			
Assume lognormal distribution.			
W value is 0.9242. This exceeds the tabled value of 0.866			
UCL (Land's method) is 31.67			

# Compliance calculations

30 1/19/98 C2a 1998-99 TCE  
 27 4/6/98  
 31 7/14/98  
 26 10/6/98  
 27 1/4/99  
 26 4/25/99  
 25 7/1/99  
 27 10/17/99

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	27.38
Censored	0	Lognormal mean	27.38
Detection limit or PQL	0.5	Std. devn.	2.065879266
Method detection limit	0.5	Median	27
TOTAL	8	Min.	25
		Max.	31
Lognormal distribution? r-squared is: 0.875			
Normal distribution? r-squared is: 0.861			
Recommendations: Assume lognormal distribution. W value is 0.8729. This exceeds the tabled value of 0.818			
UCL (Land's method) is 28.81			

# Compliance calculations

1.8 2/6/96 D2a Pre-construction TCE  
 1.8 5/7/96  
 2.6 8/6/96

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	3	Mean	2.07
Censored	0	Lognormal mean	2.08
Detection limit or PQL	0.5	Std. devn.	0.461880215
Method detection limit	0.5	Median	1.8
TOTAL	3	Min.	1.8
		Max.	2.6
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
Reject lognormal distribution.			
W value is 0.7499. This is less than the tabled value of 0.767			
Reject normal distribution.			
W value is 0.75. This is less than the tabled value of 0.767			
UCL (Land's method) is 3.46			

# Compliance calculations

4.4 11/12/96 D2a Post-construction TCE  
 4 2/10/97  
 4.3 5/19/97  
 1.8 8/4/97  
 1.8 10/21/97  
 3.1 1/19/98  
 3.6 4/6/98  
 2.2 7/14/98  
 3.2 10/6/98  
 2.4 1/15/99  
 3.099 4/25/99  
 1.8 7/4/99  
 3.2 10/17/99

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	13	Mean	2.99
Censored	0	Lognormal mean	3.01
Detection limit or PQL	0.5	Std. devn.	0.93224712
Method detection limit	0.5	Median	3.1
TOTAL	13	Min.	1.8
		Max.	4.4
Lognormal distribution?			
r-squared is:	0.921	Normal distribution?	
		r-squared is:	0.938
Recommendations:			
Assume lognormal distribution.			
W value is 0.8961. This exceeds the tabled value of 0.866			
UCL (Land's method) is 3.62			



# Compliance calculations

3.1 1/19/98 D2a 1998-99 TCE  
 3.6 4/6/98  
 2.2 7/14/98  
 3.2 10/6/98  
 2.4 1/15/99  
 3.099 4/25/99  
 1.8 7/4/99  
 3.2 10/17/99

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	2.82
Censored	0	Lognormal mean	2.84
Detection limit or PQL	0.5	Std. devn.	0.615798074
Method detection limit	0.5	Median	3.0995
TOTAL	8	Min.	1.8
		Max.	3.6
Lognormal distribution?			
r-squared is:		r-squared is:	
0.878		0.903	
Recommendations:			
Use normal distribution.			
UCL (based on t-statistic) is 3.24			

# Compliance calculations

54.8 5/17/94 E2a Pre-construction TCE  
 75 8/23/94  
 60 11/8/94  
 62 2/7/95  
 60 5/10/95  
 73 8/15/95  
 62 11/6/95  
 63 2/5/96  
 59 5/6/96  
 63 8/5/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	10	Mean	63.18
Censored	0	Lognormal mean	63.20
Detection limit or PQL	0.5	Std. devn.	6.208560399
Method detection limit	0.5	Median	62
TOTAL	10	Min.	54.8
		Max.	75
Lognormal distribution? Normal distribution?			
r-squared is: 0.868		r-squared is: 0.847	
Recommendations:			
Assume lognormal distribution.			
W value is 0.8766. This exceeds the tabled value of 0.842			
UCL (Land's method) is 66.9			

# Compliance calculations

45 11/11/96 E2a Post-construction TCE

56 2/10/97

55 5/5/97

53 8/4/97

48 10/21/97

47 1/19/98

42 4/6/98

50 7/14/98

49 10/6/98

51 1/15/99

47 4/25/99

50 7/4/99

58 10/17/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	13	Mean	50.08
Censored	0	Lognormal mean	50.09
Detection limit or PQL	0.5	Std. devn.	4.536179348
Method detection limit	0.5	Median	50
TOTAL	13	Min.	42
		Max.	58
Lognormal distribution?			
r-squared is:	0.984	Normal distribution?	
		r-squared is:	0.984
Recommendations:			
Assume lognormal distribution.			
W value is 0.9837. This exceeds the tabled value of 0.866			
UCL (Land's method) is 52.45			

# Compliance calculations

47 1/19/98 E2a 1998-99 TCE  
 42 4/6/98  
 50 7/14/98  
 49 10/6/98  
 51 1/15/99  
 47 4/25/99  
 50 7/4/99  
 58 10/17/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	49.25
Censored	0	Lognormal mean	49.27
Detection limit or PQL	0.5	Std. devn.	4.527692569
Method detection limit	0.5	Median	49.5
TOTAL	8	Min.	42
		Max.	58
Lognormal distribution? Normal distribution?			
r-squared is: 0.907		r-squared is: 0.897	
Recommendations:			
Assume lognormal distribution.			
W value is 0.9351. This exceeds the tabled value of 0.818			
UCL (Land's method) is 52.5			

# Compliance calculations

1.2 2/6/96 F2a Pre-construction TCE  
 1.3 5/7/96  
 3.4 8/6/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	3	Mean	1.97
Censored	0	Lognormal mean	2.06
Detection limit or PQL	0.5	Std. devn.	1.242309677
Method detection limit	0.5	Median	1.3
TOTAL	3	Min.	1.2
		Max.	3.4
Lognormal distribution? r-squared is:			
Normal distribution? r-squared is:			
Recommendations: Unable to analyze probability plot for lognormal case.			
Unable to analyze probability plot for normal case. Consult Statistical Guidance document			
UCL (based on t-statistic) is 4.06			

# Compliance calculations

3 11/12/96 F2a Post-construction TCE  
 0.8 2/11/97  
 1.4 5/19/97  
 1.9 8/5/97  
 2.3 10/21/97  
 1.2 1/19/98  
 1.2 4/7/98  
 2.5 7/14/98  
 3.9 10/6/98  
 0.8 1/15/99  
 0.8 4/25/99  
 2.1 7/4/99  
 3.9 10/5/99

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	13	Mean	1.98
Censored	0	Lognormal mean	2.02
Detection limit or PQL	0.5	Std. devn.	1.100640839
Method detection limit	0.5	Median	1.9
TOTAL	13	Min.	0.8
		Max.	3.9
Lognormal distribution? Normal distribution?			
r-squared is: 0.944		r-squared is: 0.914	
Recommendations:			
Assume lognormal distribution.			
W value is 0.9189. This exceeds the tabled value of 0.866			
UCL (Land's method) is 2.92			

# Compliance calculations

1.2 1/19/98 F2a 1998-99 TCE  
 1.2 4/7/98  
 2.5 7/14/98  
 3.9 10/6/98  
 0.8 1/15/99  
 0.8 4/25/99  
 2.1 7/4/99  
 3.9 10/5/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	2.05
Censored	0	Lognormal mean	2.11
Detection limit or PQL	0.5	Std. devn.	1.288409873
Method detection limit	0.5	Median	1.65
TOTAL	8	Min.	0.8
		Max.	3.9
Lognormal distribution?			
r-squared is:		Normal distribution?	
0.919		r-squared is:	
		0.873	
Recommendations:			
Assume lognormal distribution.			
W value is 0.8885. This exceeds the tabled value of 0.818			
UCL (Land's method) is 4.03			

# Compliance calculations

10 2/6/96 G2a Pre-construction TCE  
 9.7 5/6/96  
 12 8/5/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	3	Mean	10.57
Censored	0	Lognormal mean	10.59
Detection limit or PQL	0.5	Std. devn.	1.250333289
Method detection limit	0.5	Median	10
TOTAL	3	Min.	9.7
		Max.	12
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
Assume lognormal distribution.			
W value is 0.8534. This exceeds the tabled value of 0.767			
UCL (Land's method) is 13.33			



# Compliance calculations

17 11/11/96 G2a Post-construction TCE

5.4 5/20/97

7.4 8/5/97

10 10/22/97

7 1/19/98

4.5 4/7/98

9 7/14/98

4.7 10/7/98

7.4 1/5/99

4 4/6/99

7.2 7/6/99

5.6 10/6/99

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	12	Mean	7.43
Censored	0	Lognormal mean	7.43
Detection limit or PQL	0.5	Std. devn.	3.518350164
Method detection limit	0.5	Median	7.1
TOTAL	12	Min.	4
		Max.	17
Lognormal distribution?			
r-squared is:	0.932	Normal distribution?	
		r-squared is:	0.783
Recommendations:			
Assume lognormal distribution.			
W value is 0.9387. This exceeds the tabled value of 0.859			
UCL (Land's method) is 9.49			

# Compliance calculations

7 1/19/98 G2a 1998-99 TCE  
 4.5 4/7/98  
 9 7/14/98  
 4.7 10/7/98  
 7.4 1/5/99  
 4 4/6/99  
 7.2 7/6/99  
 5.6 10/6/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	6.18
Censored	0	Lognormal mean	6.21
Detection limit or PQL	0.5	Std. devn.	1.742535099
Method detection limit	0.5	Median	6.3
TOTAL	8	Min.	4
		Max.	9
Lognormal distribution?			
r-squared is:	0.951	Normal distribution?	
		r-squared is:	0.946
Recommendations:			
Assume lognormal distribution.			
W value is 0.9369. This exceeds the tabled value of 0.818			
UCL (Land's method) is 7.75			

# Compliance calculations

2.8 12/10/96 H2a Post-construction TCE  
 0.9 2/11/97  
 1.2 5/20/97  
 1.8 8/5/97  
 2 10/22/97  
 1.5 1/20/98  
 2.2 4/7/98  
 2.9 7/15/98  
 1 10/7/98  
 1.9 1/5/99  
 2 4/25/99  
 2.3 7/4/99  
 2.1 10/17/99

MTCAS <sub>Star</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	13	Mean	1.89
Censored	0	Lognormal mean	1.91
Detection limit or PQL	0.5	Std. devn.	0.618414018
Method detection limit	0.5	Median	2
TOTAL	13	Min.	0.9
		Max.	2.9
Lognormal distribution?		Normal distribution?	
r-squared is:	0.929	r-squared is:	0.965
Recommendations:			
Assume lognormal distribution.			
W value is 0.9201. This exceeds the tabled value of 0.866			
UCL (Land's method) is 2.35			

# Compliance calculations

1.5 1/20/98 H2a 1998-99 TCE  
 2.2 4/7/98  
 2.9 7/15/98  
 1 10/7/98  
 1.9 1/5/99  
 2 4/25/99  
 2.3 7/4/99  
 2.1 10/17/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	1.99
Censored	0	Lognormal mean	2.01
Detection limit or PQL	0.5	Std. devn.	0.561725657
Method detection limit	0.5	Median	2.05
TOTAL	8	Min.	1
		Max.	2.9
Lognormal distribution?			
r-squared is:		Normal distribution?	
0.891		r-squared is:	
		0.949	
Recommendations:			
Use normal distribution.			
UCL (based on t-statistic) is 2.36			

# Compliance calculations

4.9 5/18/94 I2a Pre-construction TCE  
 4.9 8/24/94  
 4.3 11/9/94  
 4.9 2/8/95  
 4.1 5/11/95  
 4.3 8/16/95  
 4.4 11/8/95  
 4.6 2/8/96  
 3.8 5/6/96  
 2.7 8/5/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	10	Mean	4.29
Censored	0	Lognormal mean	4.30
Detection limit or PQL	0.5	Std. devn.	0.669078969
Method detection limit	0.5	Median	4.35
TOTAL	10	Min.	2.7
		Max.	4.9
Lognormal distribution?		Normal distribution?	
r-squared is:	0.762	r-squared is:	0.828
Recommendations:			
Reject lognormal distribution.			
W value is 0.7771. This is less than the tabled value of 0.842			
Reject normal distribution.			
W value is 0.8372. This is less than the tabled value of 0.842			
UCL (Land's method) is 4.81			

# Compliance calculations

3.3 11/11/96 I2a Post-construction TCE  
 3.5 2/12/97  
 2.7 5/21/97  
 2 8/5/97  
 2.1 10/22/97  
 1.6 1/20/98  
 1.5 4/13/98  
 1.4 7/15/98  
 1.7 10/7/98  
 2.4 1/6/99  
 2.2999 4/7/99  
 2.3 7/6/99  
 2.2 10/17/99

MTCAS <i>Stat</i> 2.1			
Number of samples		Uncensored values	
Uncensored	13	Mean	2.23
Censored	0	Lognormal mean	2.24
Detection limit or PQL	0.5	Std. devn.	0.644701382
Method detection limit	0.5	Median	2.2
TOTAL	13	Min.	1.4
		Max.	3.5
Lognormal distribution?		Normal distribution?	
r-squared is:	0.971	r-squared is:	0.936
Recommendations:			
Assume lognormal distribution.			
W value is 0.9606. This exceeds the tabled value of 0.866			
UCL (Land's method) is 2.61			

# Compliance calculations

1.6 1/20/98 I2a 1998-99 TCE  
 1.5 4/13/98  
 1.4 7/15/98  
 1.7 10/7/98  
 2.4 1/6/99  
 2.2999 4/7/99  
 2.3 7/6/99  
 2.2 10/17/99

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	1.92
Censored	0	Lognormal mean	1.93
Detection limit or PQL	0.5	Std. devn.	0.413162889
Method detection limit	0.5	Median	1.95
TOTAL	8	Min.	1.4
		Max.	2.4
Lognormal distribution?			
r-squared is:		Normal distribution?	
0.883		r-squared is:	
		0.879	
Recommendations:			
Assume lognormal distribution.			
W value is 0.856. This exceeds the tabled value of 0.818			
UCL (Land's method) is 2.28			

# Compliance calculations

9.6 5/18/94 L2a Pre-construction TCE  
 4.1 8/24/94  
 4.5 11/9/94  
 12 2/8/95  
 7.2 5/8/95  
 4.4 8/16/95  
 4.2 11/7/95  
 14 2/8/96  
 10 5/8/96  
 5.4 8/7/96

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	10	Mean	7.54
Censored	0	Lognormal mean	7.61
Detection limit or PQL	0.5	Std. devn.	3.631712177
Method detection limit	0.5	Median	6.3
TOTAL	10	Min.	4.1
		Max.	14
Lognormal distribution?			
r-squared is:	0.904	Normal distribution?	
		r-squared is:	0.886
Recommendations:			
Assume lognormal distribution.			
W value is 0.8777. This exceeds the tabled value of 0.842			
UCL (Land's method) is 10.75			



# Compliance calculations

3.9 11/4/96 L2a Post-construction TCE

10 2/11/97

7 5/19/97

5.8 8/5/97

4.9 10/27/97

9.5 1/20/98

5.7 4/15/98

3.5 7/15/98

2.1 10/8/98

12 1/6/99

6.3 4/25/99

3.8 7/4/99

3.2 10/17/99

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	13	Mean	5.98
Censored	0	Lognormal mean	6.05
Detection limit or PQL	0.5	Std. devn.	2.961180465
Method detection limit	0.5	Median	5.7
TOTAL	13	Min.	2.1
		Max.	12
Lognormal distribution? r-squared is: 0.981			
Normal distribution? r-squared is: 0.931			
Recommendations: Assume lognormal distribution. W value is 0.9774. This exceeds the tabled value of 0.866			
UCL (Land's method) is 8.22			

# Compliance calculations

9.5 1/20/98 L2a 1998-99 TCE  
 5.7 4/15/98  
 3.5 7/15/98  
 2.1 10/8/98  
 12 1/6/99  
 6.3 4/25/99  
 3.8 7/4/99  
 3.2 10/17/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	5.76
Censored	0	Lognormal mean	5.89
Detection limit or PQL	0.5	Std. devn.	3.42509124
Method detection limit	0.5	Median	4.75
TOTAL	8	Min.	2.1
		Max.	12
Lognormal distribution?			
r-squared is:	0.974	Normal distribution?	
		r-squared is:	0.902
Recommendations:			
Assume lognormal distribution.			
W value is 0.9671. This exceeds the tabled value of 0.818			
UCL (Land's method) is 10.26			

# Compliance calculations

0.9 12/10/96 M2a Post-construction TCE  
 1.1 1/20/98  
 3.1 1/6/99  
 0.5 4/8/99

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	4	Mean	1.40
Censored	9	Lognormal mean	1.49
Detection limit or PQL	0.5	Std. devn.	1.160459679
Method detection limit	0.5	Median	1
TOTAL	13	Min.	0.5
		Max.	3.1
Lognormal distribution?			
r-squared is:	0.970	Normal distribution?	
		r-squared is:	0.905
Recommendations:			
Use lognormal distribution.			
More than 50% of the data are censored.			
Use 3.1 (largest value) as UCL.			
See Statistical Guidance Supplement S-6 (Case 3)			

# Compliance calculations

1.1 1/20/98 M2a 1998-99 TCE  
 3.1 1/6/99  
 0.5 4/8/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	3	Mean	1.57
Censored	5	Lognormal mean	1.82
Detection limit or PQL	0.5	Std. devn.	1.361371857
Method detection limit	0.5	Median	1.1
TOTAL	8	Min.	0.5
		Max.	3.1
Lognormal distribution? r-squared is: 0.998			
Normal distribution? r-squared is:			
Recommendations: Use lognormal distribution.			
Unable to analyze probability plot for normal case.			
More than 50% of the data are censored. Use 3.1 (largest value) as UCL. See Statistical Guidance Supplement S-6 (Case 3)			

# Compliance calculations

0.46 2/8/96 N2a Pre-construction TCE  
 0.4 5/12/96  
 0.6 8/12/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	3	Mean	0.49
Censored	0	Lognormal mean	0.49
Detection limit or PQL	0.5	Std. devn.	0.102632029
Method detection limit	0.5	Median	0.46
TOTAL	3	Min.	0.4
		Max.	0.6
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations: Assume lognormal distribution. W value is 0.9688. This exceeds the tabled value of 0.767			
UCL (Land's method) is 0.8			

# Compliance calculations

0.2 11/5/96 N2a Post-construction TCE  
 0.3 2/12/97  
 0.7 8/7/97  
 0.7 10/27/97  
 0.6 1/21/98

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	5	Mean	0.50
Censored	8	Lognormal mean	0.52
Detection limit or PQL	0.5	Std. devn.	0.234520788
Method detection limit	0.5	Median	0.6
TOTAL	13	Min.	0.2
		Max.	0.7
Lognormal distribution?			
r-squared is:	0.966	Normal distribution?	0.984
Recommendations:			
Use lognormal distribution.			
More than 50% of the data are censored.			
Use 0.7 (largest value) as UCL.			
See Statistical Guidance Supplement S-6 (Case 3)			

# Compliance calculations

0.6 1/21/98 N2a 1998-99 TCE

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	1	Mean	0.60
Censored	7	Lognormal mean	N/A
Detection limit or PQL	0.5	Std. devn.	N/A
Method detection limit	0.5	Median	0.6
TOTAL	8	Min.	0.6
		Max.	0.6
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations:			
<p>More than 50% of the data are censored.            Use 0.6 (largest value) as UCL.            See Statistical Guidance Supplement S-6 (Case 3)</p>			

# Compliance calculations

0.88 2/13/96 R2a Pre-construction TCE  
 0.9 5/13/96  
 1.8 8/13/96

MTCAS <i>Stat</i> 2.1			
Number of samples		Uncensored values	
Uncensored	3	Mean	1.19
Censored	0	Lognormal mean	1.22
Detection limit or PQL	0.5	Std. devn.	0.525483904
Method detection limit	0.5	Median	0.9
TOTAL	3	Min.	0.88
		Max.	1.8
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
Assume lognormal distribution.			
W value is 0.7737. This exceeds the tabled value of 0.767			
UCL (Land's method) is 5.63			



# Compliance calculations

2.3 11/5/96 R2a Post-construction TCE

0.5 2/13/97

0.9 8/7/97

1.4 10/28/97

1.9 7/20/98

1.4 10/13/98

1.3 7/6/99

1.4 10/13/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	1.39
Censored	5	Lognormal mean	1.42
Detection limit or PQL	0.5	Std. devn.	0.551459104
Method detection limit	0.5	Median	1.4
TOTAL	13	Min.	0.5
		Max.	2.3
Lognormal distribution?			
r-squared is:	0.778	Normal distribution?	
		r-squared is:	0.910
Recommendations:			
Use normal distribution.			
UCL (based on t-statistic) is 1.25			
Cohen's method applied.			

# Compliance calculations

1.9 7/20/98 R2a 1998-99 TCE  
 1.4 10/13/98  
 1.3 7/6/99  
 1.4 10/13/99

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	4	Mean	1.50
Censored	4	Lognormal mean	1.50
Detection limit or PQL	0.5	Std. devn.	0.27080128
Method detection limit	0.5	Median	1.4
TOTAL	8	Min.	1.3
		Max.	1.9
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
Unable to analyze probability plot for lognormal case.			
Unable to analyze probability plot for normal case.			
Consult Statistical Guidance document			
UCL (Land's method) is 3.73			
Cohen's method applied.			

# Compliance calculations

8.1 2/12/96 S2a Pre-construction TCE  
 8 5/14/96  
 7.3 8/13/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	3	Mean	7.80
Censored	0	Lognormal mean	7.80
Detection limit or PQL	0.5	Std. devn.	0.435889894
Method detection limit	0.5	Median	8
TOTAL	3	Min.	7.3
		Max.	8.1
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations: Unable to analyze probability plot for lognormal case.			
Unable to analyze probability plot for normal case. Consult Statistical Guidance document			
UCL (Land's method) is 8.63			

# Compliance calculations

6.6 11/6/96 S2a Post-construction TCE

5.7 2/13/97

5.9 5/27/97

5.6 8/7/97

4.7 10/28/97

4.6 1/21/98

4.3 4/14/98

3.7 7/20/98

3.6 10/13/98

3.8 1/21/99

3.7 4/13/99

3.8 7/7/99

3.5 10/13/99

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	13	Mean	4.58
Censored	0	Lognormal mean	4.58
Detection limit or PQL	0.5	Std. devn.	1.044951232
Method detection limit	0.5	Median	4.3
TOTAL	13	Min.	3.5
		Max.	6.6
Lognormal distribution?			
r-squared is:		r-squared is:	
0.902		0.884	
Recommendations:			
Assume lognormal distribution.			
W value is 0.8844. This exceeds the tabled value of 0.866			
UCL (Land's method) is 5.15			

# Compliance calculations

4.6 1/21/98 S2a 1998-99 TCE

4.3 4/14/98

3.7 7/20/98

3.6 10/13/98

3.8 1/21/99

3.7 4/13/99

3.8 7/7/99

3.5 10/13/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	3.88
Censored	0	Lognormal mean	3.88
Detection limit or PQL	0.5	Std. devn.	0.377018378
Method detection limit	0.5	Median	3.75
TOTAL	8	Min.	3.5
		Max.	4.6
Lognormal distribution?			
r-squared is:		Normal distribution?	
0.849		r-squared is:	
		0.830	
Recommendations:			
Assume lognormal distribution.			
W value is 0.8517. This exceeds the tabled value of 0.818			
UCL (Land's method) is 4.14			

# Compliance calculations

13 2/12/96 V2a Pre-construction TCE  
 13 5/15/96  
 16 8/14/96

MTCASat, 2.1			
Number of samples		Uncensored values	
Uncensored	3	Mean	14.00
Censored	0	Lognormal mean	14.03
Detection limit or PQL	0.5	Std. devn.	1.732050808
Method detection limit	0.5	Median	13
TOTAL	3	Min.	13
		Max.	16
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations: Reject lognormal distribution. W value is 0.7515. This is less than the tabled value of 0.767 Reject normal distribution. W value is 0.75. This is less than the tabled value of 0.767			
UCL (Land's method) is 17.88			

# Compliance calculations

6 11/6/96 V2a TCE Post-construction  
 15 5/27/97  
 12 8/7/97  
 2.8 10/29/97  
 5.3 1/22/98  
 10 4/16/98  
 8.6 7/20/98  
 7.8 10/14/98  
 9.5 1/11/99  
 10 4/13/99  
 11 7/7/99  
 7.7 10/13/99

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	12	Mean	8.81
Censored	0	Lognormal mean	8.99
Detection limit or PQL	0.5	Std. devn.	3.236568984
Method detection limit	0.5	Median	9.05
TOTAL	12	Min.	2.8
		Max.	15
Lognormal distribution?			
r-squared is:	0.898	Normal distribution?	
		r-squared is:	0.980
Recommendations:			
Use normal distribution.			
UCL (based on t-statistic) is 10.49			

# Compliance calculations

5.3 1/22/98 V2a TCE 1998-99  
 10 4/16/98  
 8.6 7/20/98  
 7.8 10/14/98  
 9.5 1/11/99  
 10 4/13/99  
 11 7/7/99  
 7.7 10/13/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	8.74
Censored	0	Lognormal mean	8.78
Detection limit or PQL	0.5	Std. devn.	1.799950396
Method detection limit	0.5	Median	9.05
TOTAL	8	Min.	5.3
		Max.	11
Lognormal distribution? Normal distribution?			
r-squared is: 0.873		r-squared is: 0.931	
Recommendations:			
Assume lognormal distribution.			
W value is 0.8846. This exceeds the tabled value of 0.818			
UCL (Land's method) is 10.43			



# Compliance calculations

53.6 5/17/94 B2 Pre-construction TCE

61 8/23/94

50 11/8/94

59 2/7/95

53 5/10/95

55 8/15/95

55 11/6/95

59 2/5/96

54 5/6/96

53 8/5/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	10	Mean	55.26
Censored	0	Lognormal mean	55.27
Detection limit or PQL	0.5	Std. devn.	3.387624536
Method detection limit	0.5	Median	54.5
TOTAL	10	Min.	50
		Max.	61
Lognormal distribution?			
r-squared is:		Normal distribution?	
0.932		r-squared is:	
		0.927	
Recommendations:			
Assume lognormal distribution.			
W value is 0.9335. This exceeds the tabled value of 0.842			
UCL (Land's method) is 57.29			

# Compliance calculations

50 11/11/96 B2 Post-construction TCE  
 56 2/10/97  
 49 5/6/97  
 49 8/4/97  
 48 10/21/97  
 44 1/19/98  
 40 4/6/98  
 45 7/14/98  
 42 10/6/98  
 41 1/15/99  
 39 4/25/99  
 40 7/4/99  
 42 10/17/99

MTCAS <i>Stat</i> 2.1			
Number of samples		Uncensored values	
Uncensored	13	Mean	45.00
Censored	0	Lognormal mean	45.02
Detection limit or PQL	0.5	Std. devn.	5.066228051
Method detection limit	0.5	Median	44
TOTAL	13	Min.	39
		Max.	56
Lognormal distribution? Normal distribution?			
r-squared is: 0.936		r-squared is: 0.920	
Recommendations:			
Assume lognormal distribution.			
W value is 0.9285. This exceeds the tabled value of 0.866			
UCL (Land's method) is 47.61			

# Compliance calculations

44 1/19/98 B2 1998-99 TCE  
 40 4/6/98  
 45 7/14/98  
 42 10/6/98  
 41 1/15/99  
 39 4/25/99  
 40 7/4/99  
 42 10/17/99

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	41.63
Censored	0	Lognormal mean	41.63
Detection limit or PQL	0.5	Std. devn.	2.065879266
Method detection limit	0.5	Median	41.5
TOTAL	8	Min.	39
		Max.	45
Lognormal distribution? Normal distribution?			
r-squared is: 0.955		r-squared is: 0.950	
Recommendations:			
Assume lognormal distribution.			
W value is 0.9438. This exceeds the tabled value of 0.818			
UCL (Land's method) is 43.05			

# Compliance calculations

41.4 5/17/94 C2 Pre-construction TCE

41 8/23/94

42 11/8/94

39 2/7/95

39 5/10/95

46 8/15/95

39 11/6/95

40 2/6/96

39 5/7/96

41 8/6/96

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	10	Mean	40.74
Censored	0	Lognormal mean	40.74
Detection limit or PQL	0.5	Std. devn.	2.172658382
Method detection limit	0.5	Median	40.5
TOTAL	10	Min.	39
		Max.	46
Lognormal distribution? r-squared is: 0.800			
Normal distribution? r-squared is: 0.783			
Recommendations: Reject lognormal distribution. W value is 0.8057. This is less than the tabled value of 0.842 Reject normal distribution. W value is 0.7927. This is less than the tabled value of 0.842			
UCL (Land's method) is 42			

# Compliance calculations

39 11/12/96 C2 Post-construction TCE

47 2/11/97

43 5/19/97

43 8/4/97

42 10/21/97

44 1/19/98

48 4/6/98

44 7/14/98

50 10/6/98

49 1/15/99

45 4/25/99

52 7/4/99

54 10/17/99

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	13	Mean	46.15
Censored	0	Lognormal mean	46.17
Detection limit or PQL	0.5	Std. devn.	4.298180891
Method detection limit	0.5	Median	45
TOTAL	13	Min.	39
		Max.	54
Lognormal distribution? r-squared is: 0.979			
Normal distribution? r-squared is: 0.975			
Recommendations: Assume lognormal distribution. W value is 0.9766. This exceeds the tabled value of 0.866			
UCL (Land's method) is 48.39			

# Compliance calculations

44 1/19/98 C2 1998-99 TCE  
 48 4/6/98  
 44 7/14/98  
 50 10/6/98  
 49 1/15/99  
 45 4/25/99  
 52 7/4/99  
 54 10/17/99

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	48.25
Censored	0	Lognormal mean	48.27
Detection limit or PQL	0.5	Std. devn.	3.732100136
Method detection limit	0.5	Median	48.5
TOTAL	8	Min.	44
		Max.	54
Lognormal distribution? Normal distribution?			
r-squared is: 0.948		r-squared is: 0.949	
Recommendations:			
Assume lognormal distribution.			
W value is 0.9249. This exceeds the tabled value of 0.818			
UCL (Land's method) is 50.91			

# Compliance calculations

89.4 5/17/94 E2 Pre-construction TCE

82 8/23/94

92 11/8/94

93 2/7/95

89 5/10/95

97 8/15/95

95 11/6/95

100 2/5/96

91 5/6/96

100 8/5/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	10	Mean	92.84
Censored	0	Lognormal mean	92.86
Detection limit or PQL	0.5	Std. devn.	5.504583948
Method detection limit	0.5	Median	92.5
TOTAL	10	Min.	82
		Max.	100
Lognormal distribution?			
r-squared is:		Normal distribution?	
0.943		r-squared is:	
		0.952	
Recommendations:			
Assume lognormal distribution.			
W value is 0.9455. This exceeds the tabled value of 0.842			
UCL (Land's method) is 96.21			

# Compliance calculations

89 11/11/96 E2 Post-construction TCE

93 2/10/97

87 5/5/97

93 8/4/97

89 10/20/97

81 1/19/98

80 4/6/98

83 7/14/98

83 10/6/98

81 1/15/99

82 4/25/99

89 7/4/99

93 10/17/99

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	13	Mean	86.38
Censored	0	Lognormal mean	86.40
Detection limit or PQL	0.5	Std. devn.	4.941970955
Method detection limit	0.5	Median	87
TOTAL	13	Min.	80
		Max.	93

Lognormal distribution?	Normal distribution?
r-squared is: 0.905	r-squared is: 0.903

Recommendations:  
Assume lognormal distribution.  
W value is 0.8795. This exceeds the tabled value of 0.866

UCL (Land's method) is 88.9



# Compliance calculations

81 1/19/98 E2 1998-99 TCE  
 80 4/6/98  
 83 7/14/98  
 83 10/6/98  
 81 1/15/99  
 82 4/25/99  
 89 7/4/99  
 93 10/17/99

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	84.00
Censored	0	Lognormal mean	84.01
Detection limit or PQL	0.5	Std. devn.	4.566962104
Method detection limit	0.5	Median	82.5
TOTAL	8	Min.	80
		Max.	93
Lognormal distribution?			
r-squared is:		Normal distribution?	
0.808		r-squared is:	
		0.797	
Recommendations:			
Reject lognormal distribution.			
W value is 0.8068. This is less than the tabled value of 0.818			
Reject normal distribution.			
W value is 0.7994. This is less than the tabled value of 0.818			
UCL (Land's method) is 87.1			

# Compliance calculations

82.6 5/17/94 F2 Pre-construction TCE  
 71 8/23/94  
 78 11/8/94  
 78 2/7/95  
 74 5/10/95  
 91 8/15/95  
 74 11/6/95  
 77 2/5/96  
 70 5/6/96  
 65 8/5/96

MTCAS <i>Stat</i> 2.1			
Number of samples		Uncensored values	
Uncensored	10	Mean	76.06
Censored	0	Lognormal mean	76.09
Detection limit or PQL	0.5	Std. devn.	7.207434433
Method detection limit	0.5	Median	75.5
TOTAL	10	Min.	65
		Max.	91
Lognormal distribution?		Normal distribution?	
r-squared is:	0.960	r-squared is:	0.944
Recommendations:			
Assume lognormal distribution.			
W value is 0.9736. This exceeds the tabled value of 0.842			
UCL (Land's method) is 80.45			

# Compliance calculations

66 11/11/96 F2 Post-construction TCE

72 2/11/97

70 5/19/97

69 8/5/97

67 10/21/97

58 1/19/98

61 4/7/98

63 7/14/98

51 10/6/98

60 1/15/99

59 4/25/99

61 7/4/99

66 10/17/99

MTCAS <i>Stat</i> 2.1			
Number of samples		Uncensored values	
Uncensored	13	Mean	63.31
Censored	0	Lognormal mean	63.33
Detection limit or PQL	0.5	Std. devn.	5.77905147
Method detection limit	0.5	Median	63
TOTAL	13	Min.	51
		Max.	72
Lognormal distribution?      Normal distribution?			
r-squared is: 0.946		r-squared is: 0.963	
Recommendations:			
Assume lognormal distribution.			
W value is 0.951. This exceeds the tabled value of 0.866			
UCL (Land's method) is 66.42			

# Compliance calculations

58 1/19/98 F2 1998-99 TCE  
 61 4/7/98  
 63 7/14/98  
 51 10/6/98  
 60 1/15/99  
 59 4/25/99  
 61 7/4/99  
 66 10/17/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	59.88
Censored	0	Lognormal mean	59.90
Detection limit or PQL	0.5	Std. devn.	4.356850107
Method detection limit	0.5	Median	60.5
TOTAL	8	Min.	51
		Max.	66

Lognormal distribution?	Normal distribution?
r-squared is: 0.874	r-squared is: 0.897

Recommendations:

Assume lognormal distribution.

W value is 0.8994. This exceeds the tabled value of 0.818

UCL (Land's method) is 63.09

# Compliance calculations

42.4 5/18/94 G2 Pre-construction TCE

43 8/24/94

36 11/8/94

36 2/8/95

37 5/10/95

40 8/15/95

36 11/7/95

41 2/6/96

39 5/6/96

44 8/5/96

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	10	Mean	39.44
Censored	0	Lognormal mean	39.45
Detection limit or PQL	0.5	Std. devn.	3.102400504
Method detection limit	0.5	Median	39.5
TOTAL	10	Min.	36
		Max.	44
Lognormal distribution?			
r-squared is:	0.919	Normal distribution?	
		r-squared is:	0.921
Recommendations:			
Assume lognormal distribution.			
W value is 0.8902. This exceeds the tabled value of 0.842			
UCL (Land's method) is 41.34			

# Compliance calculations

38 11/11/96 G2 Post-construction TCE

43 2/11/97

42 5/20/97

42 8/5/97

40 10/22/97

38 1/19/98

38 4/7/98

46 7/14/98

40 10/7/98

39 1/15/99

41 4/25/99

41 7/4/99

42 10/17/99

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	13	Mean	40.77
Censored	0	Lognormal mean	40.77
Detection limit or PQL	0.5	Std. devn.	2.314945865
Method detection limit	0.5	Median	41
TOTAL	13	Min.	38
		Max.	46
Lognormal distribution? r-squared is: 0.932			
Normal distribution? r-squared is: 0.923			
Recommendations:			
Assume lognormal distribution.			
W value is 0.9299. This exceeds the tabled value of 0.866			
UCL (Land's method) is 41.93			

# Compliance calculations

38 1/19/98 G2 1998-99 TCE  
 38 4/7/98  
 46 7/14/98  
 40 10/7/98  
 39 1/15/99  
 41 4/25/99  
 41 7/4/99  
 42 10/17/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	40.63
Censored	0	Lognormal mean	40.63
Detection limit or PQL	0.5	Std. devn.	2.615202806
Method detection limit	0.5	Median	40.5
TOTAL	8	Min.	38
		Max.	46
Lognormal distribution? r-squared is: 0.897			
Normal distribution? r-squared is: 0.880			
Recommendations: Assume lognormal distribution. W value is 0.9011. This exceeds the tabled value of 0.818			
UCL (Land's method) is 42.42			

# Compliance calculations

51 2/9/94 I2 Pre-construction TCE  
 62 5/18/94  
 73 8/24/94  
 66 11/9/94  
 63 2/8/95  
 60 5/11/95  
 77 8/16/95  
 68 11/8/95  
 68 2/8/96  
 57 5/6/96  
 55 8/5/96

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	11	Mean	63.64
Censored	0	Lognormal mean	63.68
Detection limit or PQL	0.5	Std. devn.	7.775252115
Method detection limit	0.5	Median	63
TOTAL	11	Min.	51
		Max.	77
Lognormal distribution?			
r-squared is:	0.992	Normal distribution?	
		r-squared is:	0.992
Recommendations:			
Assume lognormal distribution.			
W value is 0.9872. This exceeds the tabled value of 0.85			
UCL (Land's method) is 68.31			



# Compliance calculations

59 11/11/96 I2 Post-construction TCE

58 2/12/97

53 5/21/97

50 8/5/97

50 10/22/97

45 1/20/98

39 4/13/98

46 7/15/98

38 10/7/98

44 1/15/99

43 4/25/99

44 7/4/99

45 10/17/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	13	Mean	47.23
Censored	0	Lognormal mean	47.26
Detection limit or PQL	0.5	Std. devn.	6.495560614
Method detection limit	0.5	Median	45
TOTAL	13	Min.	38
		Max.	59
Lognormal distribution?			
r-squared is:	0.956	Normal distribution?	
Recommendations:		r-squared is:	0.940
Assume lognormal distribution.			
W value is 0.9474. This exceeds the tabled value of 0.866			
UCL (Land's method) is 50.67			

# Compliance calculations

45 1/20/98 I2 1998-99 TCE  
 39 4/13/98  
 46 7/15/98  
 38 10/7/98  
 44 1/15/99  
 43 4/25/99  
 44 7/4/99  
 45 10/17/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	43.00
Censored	0	Lognormal mean	43.02
Detection limit or PQL	0.5	Std. devn.	2.927700219
Method detection limit	0.5	Median	44
TOTAL	8	Min.	38
		Max.	46
Lognormal distribution? . Normal distribution?			
r-squared is:	0.833	r-squared is:	0.845
Recommendations:			
Assume lognormal distribution.			
W value is 0.8257. This exceeds the tabled value of 0.818			
UCL (Land's method) is 45.15			

# Compliance calculations

37 2/9/94 L2 Pre-construction TCE  
 31.7 5/18/94  
 33 8/24/94  
 32 11/9/94  
 30 2/8/95  
 30 5/10/95  
 32 8/15/95  
 23 11/6/95  
 33 2/7/96  
 29 5/9/96  
 28 8/7/96

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	11	Mean	30.79
Censored	0	Lognormal mean	30.82
Detection limit or PQL	0.5	Std. devn.	3.535662468
Method detection limit	0.5	Median	31.7
TOTAL	11	Min.	23
		Max.	37
Lognormal distribution?		Normal distribution?	
r-squared is:	0.881	r-squared is:	0.913
Recommendations:			
Use normal distribution.			
UCL (based on t-statistic) is 32.72			

# Compliance calculations

27 11/11/96 L2 Post-construction TCE  
 29 2/11/97  
 26 5/19/97  
 29 8/5/97  
 26 10/27/97  
 27 1/20/98  
 24 4/15/98  
 27 7/15/98  
 24 10/8/98  
 24 1/15/99  
 25 4/25/99  
 27 7/4/99  
 26 10/17/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	13	Mean	26.23
Censored	0	Lognormal mean	26.23
Detection limit or PQL	0.5	Std. devn.	1.690850188
Method detection limit	0.5	Median	26
TOTAL	13	Min.	24
		Max.	29
Lognormal distribution?		Normal distribution?	
r-squared is:	0.922	r-squared is:	0.921
Recommendations:			
Assume lognormal distribution.			
W value is 0.9058. This exceeds the tabled value of 0.866			
UCL (Land's method) is 27.1			

# Compliance calculations

27 1/20/98 L2 1998-99 TCE  
 24 4/15/98  
 27 7/15/98  
 24 10/8/98  
 24 1/15/99  
 25 4/25/99  
 27 7/4/99  
 26 10/17/99

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	25.50
Censored	0	Lognormal mean	25.50
Detection limit or PQL	0.5	Std. devn.	1.414213562
Method detection limit	0.5	Median	25.5
TOTAL	8	Min.	24
		Max.	27
Lognormal distribution?		Normal distribution?	
r-squared is:	0.838	r-squared is:	0.838
Recommendations:			
Reject lognormal distribution.			
W value is 0.797. This is less than the tabled value of 0.818			
Reject normal distribution.			
W value is 0.7986. This is less than the tabled value of 0.818			
UCL (Land's method) is 26.49			

# Compliance calculations

12 2/9/94 M2 Pre-construction TCE  
 14.6 5/18/94  
 15 8/24/94  
 11 11/9/94  
 13 2/8/95  
 14 5/10/95  
 13 8/15/95  
 14 11/6/95  
 13 2/8/96  
 14 5/9/96  
 11 8/12/96

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	11	Mean	13.15
Censored	0	Lognormal mean	13.15
Detection limit or PQL	0.5	Std. devn.	1.35378258
Method detection limit	0.5	Median	13
TOTAL	11	Min.	11
		Max.	15
Lognormal distribution? r-squared is: 0.916			
Normal distribution? r-squared is: 0.931			
Recommendations: Assume lognormal distribution. W value is 0.9017. This exceeds the tabled value of 0.85			
UCL (Land's method) is 13.97			

# Compliance calculations

9 11/5/96  
4.9 2/12/97  
13 5/21/97  
12 8/7/97  
7.8 10/27/97  
7.5 1/20/98  
0.5 4/13/98  
8.8 7/15/98  
3.6 10/12/98  
4.1 1/15/99  
5.1999 4/25/99  
2.3 7/4/99  
0.8 10/17/99

M2 Post-construction TCE

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	13	Mean	6.12
Censored	0	Lognormal mean	7.27
Detection limit or PQL	0.5	Std. devn.	3.97237446
Method detection limit	0.5	Median	5.1999
TOTAL	13	Min.	0.5
		Max.	13
Lognormal distribution?			
r-squared is:		Normal distribution?	
0.873		r-squared is:	
		0.973	
Recommendations:			
Use normal distribution.			
UCL (based on t-statistic) is 8.08			

# Compliance calculations

7.5 1/20/98 M2 1998-99 TCE  
 0.5 4/13/98  
 8.8 7/15/98  
 3.6 10/12/98  
 4.1 1/15/99  
 5.1999 4/25/99  
 2.3 7/4/99  
 0.8 10/17/99

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	8	Mean	4.10
Censored	0	Lognormal mean	4.89
Detection limit or PQL	0.5	Std. devn.	2.980886254
Method detection limit	0.5	Median	3.85
TOTAL	8	Min.	0.5
		Max.	8.8
Lognormal distribution? r-squared is: 0.915			
Normal distribution? r-squared is: 0.964			
Recommendations: Assume lognormal distribution. W value is 0.9033. This exceeds the tabled value of 0.818			
UCL (based on t-statistic) is 6.1			



# Compliance calculations

0.32 2/13/96 R2 Pre-construction TCE  
 0.3 5/13/96  
 0.3 8/13/96

MTCAS <sub>stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	3	Mean	0.31
Censored	0	Lognormal mean	0.31
Detection limit or PQL	0.2	Std. devn.	0.011547005
Method detection limit	0.2	Median	0.3
TOTAL	3	Min.	0.3
		Max.	0.32

Lognormal distribution? r-squared is:	Normal distribution? r-squared is:
------------------------------------------	---------------------------------------

Recommendations:  
Reject lognormal distribution.  
W value is 0.7563. This is less than the tabled value of 0.767  
Reject normal distribution.  
W value is 0.75. This is less than the tabled value of 0.767

UCL (Land's method) is 0.33

# Compliance calculations

0.2 11/5/96 R2 Post-construction TCE

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	1	Mean	0.20
Censored	11	Lognormal mean	N/A
Detection limit or PQL	0.5	Std. devn.	N/A
Method detection limit	0.5	Median	0.2
TOTAL	12	Min.	0.2
		Max.	0.2
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
Unable to analyze probability plots.			
Consult Statistical Guidance document			
More than 50% of the data are censored.			
Use 0.2 (largest value) as UCL.			
See Statistical Guidance Supplement S-6 (Case 3)			

# Compliance calculations

0.4 10/13/99 S2 1998-99 TCE

MTCAS <sub>Stat</sub> 2.1			
Number of samples		Uncensored values	
Uncensored	1	Mean	0.40
Censored	7	Lognormal mean	N/A
Detection limit or PQL	0.5	Std. devn.	N/A
Method detection limit	0.5	Median	0.4
TOTAL	8	Min.	0.4
		Max.	0.4
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
Unable to analyze probability plots.			
Consult Statistical Guidance document			
More than 50% of the data are censored.			
Use 0.4 (largest value) as UCL.			
See Statistical Guidance Supplement S-6 (Case 3)			

# Compliance calculations

7.7 10/14/99 MW-71 1998-99 TCE

MTCASat 2.1			
Number of samples		Uncensored values	
Uncensored	1	Mean	7.70
Censored	7	Lognormal mean	N/A
Detection limit or PQL	0.5	Std. devn.	N/A
Method detection limit	0.5	Median	7.7
TOTAL	8	Min.	7.7
		Max.	7.7
Lognormal distribution? r-squared is:		Normal distribution? r-squared is:	
Recommendations: Unable to analyze probability plots. Consult Statistical Guidance document			
More than 50% of the data are censored. Use 7.7 (largest value) as UCL. See Statistical Guidance Supplement S-6 (Case 3)			